Running Head: PERCEIVED CONTROL AND HEALTH HABITS

Perceived Control and Health Habits among Elderly Adults with Chronic Disease

WU Man Sze Anise

A Thesis Submitted in Partial Fulfillment

of the Requirements for the Degree of

Master of Philosophy

in

Psychology

August 2001

ACKNOWLEDGEMENTS

I would like to send my deepest gratitude to my supervisor, Professor Catherine Tang, for her guidance and help in not only the preparation of this thesis, but also many aspects of my life throughout these two years. I would also like to express my sincere thanks to Professor Timothy Kwok, who helped me a lot in recruiting the participants of this study as well as in improving my thesis design. Moreover, I wish to acknowledge the insightful and valuable comments of Professor Darius Chan on the design and data analysis of this thesis.

During the data collection period, I have received substantial assistance from many people. First, I would like to express my appreciation to Ms Rebecca Wong and other staffs in the Endocrine and Diabetes Clinic of the Prince of Wales Hospital as they kindly referred potential participants to me and cleared up many of my doubts on diabetes mellitus. In addition, I am indebted to Ms. Yan Tam, Ms. Elsie Yan, and Dannii Yeung, who shared my burden in interviewing with the elderly participants.

Last but not least, I thank my friends, for their emotional supports and advice in statistical analysis of this study, as well as my family, for their unlimited support and care throughout these years.

ABSTRACT

The present study aimed to test the applicability of Wallston's modified social learning theory (1989) in predicting health habits of Chinese elderly patients with non-insulin-dependent diabetes mellitus. The predictive power of the salient social cognitive variables of the theory across two time points was also examined. At Time 1, 191 Chinese elderly patients (117 males and 74 females) with non-insulin-dependent diabetes mellitus were interviewed. Healthful habits practiced by the elderly participants were assessed and two underlying dimensions, diabetes-related and preventive health habits, were identified. Results showed that participants' overall, diabetes-related, or preventive health habits were determined by their health value, self-efficacy, and the health locus of control constructs, but not by their demographic or medical characteristics. However, results did not support the moderator effects of the cognitive constructs suggested by Wallston (1989). Both health value and self-efficacy emerged as the most reliable determinants of health habits. Internal health locus of control was found to be another significant predictor for both general and preventive health habits, while doctor health locus of control individually exerted its positive effect on general and diabetes-related health habits. Follow-up telephone interviews were conducted to assess the participants' health habits six months later. Results demonstrated that health habits were generally stable across the two measurement time points. After controlling health habits at Time 1, health value and self-efficacy predicted health habits practice at six months later. Some demographic variables and social cognitive factors accounted for a large amount of the variances of healthful habits for Time 1 and six-month follow-up. Results illustrated the significance of considering the specificity of assessment tools on cognitive variables and target population. Research and practical implications of the current study were also discussed.

摘要

本研究之目的為驗證華士頓(1989)修訂的社會學習論於預測非胰島素依賴性糖尿病(non-insulin-dependent diabetes mellitus)的中國老年患者的健康習慣之適用性。理論內的社會認知對變項患者的健康習慣之預測力亦分別在兩階段被測察。在第一階段，我們訪問了 191 名患有非胰島素依賴性糖尿病的中國老年病人(117 男及 74 女)。在評估了老年參與者的健康習慣之後，我們發現其中的兩大根本的範疇，分別為與糖尿相關的和屬預防性的健康習慣。分析結果顯示，病者的整體、與糖尿相關的或屬預防性的健康習慣，均受其健康價值、自我效能和健康制控觀所決定，與其人口統計或醫學的特徵之關係不大。然而，結果並不支持華士頓(1989)提出的認知變項乃干涉變項之主張。健康價值及自我效能均為最可靠的因素去決定健康習慣的實踐。另外，自主健康制控觀是影響整體和與糖尿相關的習慣方面另一重要因素。醫師健康制控觀則正面地影響整體和屬預防性的習慣。我們於六個月後進行跟進電話訪問，發現參與者的健康習慣一般並無大改變。在控制了第一階段所評估的健康習慣下，參與者的健康價值及自我效能仍影響其六個月後健康習慣的實踐。人口統計特徵及社會認知變項在很大程度上解釋了參與者當前及將來於健康習慣上的變化。而且，分析結果點出，考慮認知變項的評估工具之精確度及清楚地指定一目標人口是非常重要的。最後，我們亦會討論本研究在研究和應用上的意義。

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

Introduction

Understanding the elderly population is important because the population of Hong Kong is rapidly aging due to the decreasing birth rates and increasing life expectancy. For example, the average life expectancy at birth in Hong Kong has increased from 72.3 years in 1971 to 77.2 years in 1998 for men and 78.5 years in 1971 to 82.6 years in 1998 for women (Census & Statistics Department, 1999). Currently, about 10.4% of the total population in Hong Kong are 65 years or older, and there is an increment of 2.8% from 1991. This percentage will continue to rise in the coming years with the lengthening of life expectancy. Both the life expectancy and elderly population of Hong Kong is similar to other developed countries like the U.S.A. and the U.K. (Hong Kong Hospital Authority, 1997/98).

"Health" is a main focus in geriatric studies as aging is a common risk factor of many chronic illnesses like diabetes and heart diseases. The physical health of the elderly severely influences the quality of life in the individual, family and community level. Certainly, the health of an aged individual affects his/her physical, psychological, and social functioning. For instance, there is positive correlation between different physical health status indices and life satisfaction of the Chinese elderly (Chi & Lee, 1989). His/her family members may also suffer psychologically when he/she is chronically ill (Taylor, 1999). Moreover, in Hong Kong, the cost of caring for the health of elderly people is shared mainly by the government and their own families. As the old are more susceptible to illnesses and thus become the main users of medical services (Kart, 1985), the aging population will have a significant impact on the disease pattern of the community and the planning of health care system.

Local studies have suggested that the general physical health of Hong Kong elderly people is not comparatively good and the majority of the elderly had experienced at least one chronic disease (e.g. Chi & Lee, 1991). Therefore, ways of improving both the health and quality of life of the elderly have become a main concern of both the local government and welfare organizations. Among all relevant areas, health habit practice is specifically important because it is most cost-effective "medicine" with both prevention and treatment effects. Accordingly, psychological factors contributing to elderly people's healthful habits practices have to be explored as well. These factors may be incorporated into health-promotion programs for the elderly patients. However, information about elderly people's beliefs and attitudes regarding health is lacking (Coppard, 1985).

Health Habits

Health Habits and Health Status of Elderly Adults

A habit is one's settled practice or usual behavior. There is a bulk of empirical support for the inter-correlationship between habits and health (Swanson, 1999). Health habits are shown to be associated with mortality (Breslow & Enstrom, 1980). In the early period of the last century, infectious agents were the main cause of mortality and illness. Today, unhealthful habits and behaviors have become the major cause or mortality and illness (Fries & Crapo, 1986). On the other hand, regular practice of behaviors like balanced diet, exercise, enough sleep, relaxation and regular physical examinations are considered to be health-promoting in Western as well as in Chinese population (Hanson, 1984).

As a result, one of the most effective ways to promote elders' health is to encourage them to participate in healthful habits (Pan American Health Organization, 1985). Fulder's (1983) and Walford's studies (1983) provided evidence that changes in habits affect health even in later old age. Simple correlations between health status and health habits have also been replicated in Chinese elderly sample (Chi & Lee, 1989). One the other hand, some researchers suggest that these habits may not definitely relate to health status of the elderly. For example, Quinn and Johnson (1997) failed to find an association between nutritionally healthful behaviors and health status among adults who aged over 60 years. They suggested little variation in health status among the sample due to sampling bias as a possible reason for the non-significant relationship between health habits and health status. Though the impact of health habits on health status is not entirely clear in the older population, most people, including health professionals, believe the health-promoting effect of healthful habits, regardless of the physical condition of an individual.

Health status also influences aged people's capability to undertake health behaviors. Poor physical functioning can create perceived barriers when the elderly want to pursue some healthful habits (Stoller & Pollow, 1994). Therefore, when studying the behaviors of elderly people with illness diagnosis, their health status should be taken into consideration. Among elderly patients, health status, especially physical functioning, may act as perceived prerequisite of engaging in healthful habits. In turn, more healthful behaviors should lead to better future health.

Health Habits among Chinese Elders with Diabetes

It is doubtless that healthful habits do not harm one's health but help prevent disease initially and reduce secondary risk and the risk of disability once a disease has been diagnosed (Taylor & Aspinwall, 1991). In contrast, unhealthful habits such as unbalanced diet, lack of exercises, and smoking damage one's health and elicit the onset and progression of different kinds of chronic diseases like diabetes mellitus (DM) (Hamman, 1992).

Diabetes mellitus (DM) is one of the top killers of people aged 65 years and above in Hong Kong (Hong Kong Department of Health, 1997/98). In terms of mortality rate and economic burden, DM is one of the major health problems in many well-developed regions, including Hong Kong (Woo, Ho, Chan, Yu, Yuen & Lau, 1997). Though there is no known cure for DM, both diet and exercises are essential components of diabetes treatment in order to keep blood glucose in normal range and to prevent long-term complications like heart and renal diseases (Kerson & Kerson, 1985; Swanson, 1999).

There are two types of diabetes mellitus, insulin-dependent and noninsulin-dependent. Both of them are associated with absolute or relative deficiencies in insulin action and/or secretion, and result in the same long-term health problems. Their symptoms are similar in that both include excessive thirst, frequent urination, and sudden weight loss. However, the symptoms may begin gradually and may be hard to identify at first. The insulin-dependent cases are less implicated with environmental risk factors like nutrition in etiology and more restricted in management than the noninsulin-dependent ones (Cox, Gonder-Frederick, Pohl, & Pennebaker, 1986). Non-insulin-dependent diabetes mellitus (NIDDM) composes the majority of cases of diabetes in both developed and developing countries and the risk of developing NIDDM increases with age (World Health Organization (WHO), 1994). Hence NIDDM is a more representative example of typical chronic diseases among the elderly. In Hong Kong, the prevalence of NIDDM was found to be around 15% among the 60-80 years old and more than 17% in those aged 80 years or over (Kung & Janus, 1997).

Health habits are significantly associated with the progression of NIDDM among elderly (WHO, 1994). People diagnosed with NIDDM have the primary responsibility for daily care, which includes a tremendous modification of their lifestyle. For example, they need to reduce intake of saturated fats and cholesterol, avoid heavy meal, eat more foods with fiber, and engage in exercise program (Swanson, 1999). Furthermore, some health habits such as watching for possible signs of health problems (for instance, foot problems) do not directly related to metabolic control, but are important in reducing likelihood of developing complications. Psychological variables such as locus of control have also been hypothesized to have impact upon the diabetes management and control (Shillitoe, 1988). Thus, it is particularly important to investigate the factors influencing the implementation of healthful habits in the population of elderly NIDDM patients, who are not only obliged to bear unique responsibility of self-care to control diabetes, but also vulnerable to other health problems. Healthful habits work in both controlling NIDDM as well as reducing their vulnerability to bad health.

Measurement of Health Habits

In order to conduct a reliable test of the relationship between health habits and various psychological constructs among the elderly patients, different dimensions of health habits would be considered. There have been several attempts to develop valid and reliable instruments in order to measure behaviors, habits, and lifestyle in the context of health (e.g. Langlie, 1977; Pender, 1982; Vickers, Conway, & Hervig, 1990; Walker, Sechrist, & Pender, 1987). These studies demonstrated that health behaviors, or habits, are multi-dimensional and thus, from theoretical and measurement perspectives, these behaviors should not be simply treated as neither totally independent nor a single entity. For example, Quinn and Johnson (1997) have identifies two factors in nutritionally healthful behaviors, while Kronenfeld and her colleagues (1988) has demonstrated that health habits of alcohol consumption, smoking, stress management, diet, weight control and exercise did not form a single dimension of health behaviors. It should be noted that the components of a habit dimension might vary across population. Among the elderly patients with chronic illness, it is possible that some habits, such as no smoking, directly protect them from further development of illness, whereas some habits, like gathering information about health, indirectly promote health by reducing risk. Ignorance of the presence of different dimensions of health habits may hide the actual link between habits and health status, as well as other psychosocial variables like health beliefs.

In local studies of these health-related behaviors, either single item concerned with one specific behavior or simple summation score of several items of health behaviors, regardless of their dimensions, is commonly found. One reason for this common practice may be the lack of local research instrument of health behaviors. Therefore, the first aim of the present study is to test the psychometric properties of a scale for measuring health habits among Chinese elderly patients with NIDDM, as well as the associations of different dimensions of health habits and health status.

Perceived Control

Perceived Control over Health

Research on personal habits stresses the importance of self-care in maintaining health. Self-care is not a new idea and the World Health Organization has also promoted self-care/health for several decades (Coppard, 1985). One of the basic components of self-care is an individual's concern and responsibility to his/her health, including all the decisions and actions to maintain and enhance one's health (Coppard, 1985). Implementing healthful habits is one of the major categories of these actions. Such decisions and actions are under direct, personal control.

From the social learning perspective, human beings engage a particular behavior with "integrative, reflective, and creative forms of thought" (Bandura, 1984), and not merely emit a conditioned response. Such forethought includes self-evaluation of control. Personal control has been recognized as an important psychological concept in understanding the relationship of health and behaviors (Conner & Norman, 1996; Shaprio, Schwartz, & Astin, 1996; Steptoe & Appels, 1989; Ziff & Conrad, 1995). Several issues, from the "match vs. mismatch" principle (Shapio et. al, 1996), realistic boundaries of adaptive function of control (Helgeson, 1992), to the "contextual specificity" problem of the psychometric measures (e.g. Smith, Wallston, & Smith, 1995; Wallston, Stein, & Smith, 1994) have been arisen recently and suggested that various confounding factors in past studies on perceived control have been recognized. For instance, it is generally assumed that one who believes having control over his/her health usually performs more health promoting behaviors and thus is more healthy (Conner & Norman, 1996). However, recent researchers have suggested that too much control belief over disease may induce negative health outcomes, if ability, control cognitions, as well as control desire are mismatched (Shapio et al., 1996). As a result, there is a need to re-examine the influence of perception of control and its interactions with other variables on healthful lifestyle. The aim of the present study is to examine the influences of three salient psychological factors, including health locus of control (HLC), health value (HV) and self-efficacy (SE), as well as their interactions on health-related behaviors among elderly people with NIDDM.

Health Locus of Control and Health Value

According to the social learning theory, "the likelihood of a behavior to occur in a given situation is a function of individual's expectancy that the behavior that will lead to a particular reinforcement, and the extent to which the reinforcement is valued" (Norman & Bennett, 1996). In this theoretical framework, locus of control represents "control of reinforcement" (Rotter, 1975) and focuses on expectancies for the causes of future events (Norman & Bennett, 1996).

Locus of control is an essential construct in early social learning theory (Rotter, 1975) and Internal-External Scale (I-E Scale; Rotter, 1966) is widely used in assessing a person's beliefs regarding where certain important outcomes lie. A person possess an internal locus of control if he/she believes that his/her own behaviors exert influences on the outcomes, while he/she is said to possess an external locus of control if he/she believes that the outcomes are dependent upon other people's actions, or a matter of "chance" variables like luck (i.e. unpredictable). The I-E Scale measures generalized expectancy of personal control over certain outcomes and is used in the prediction of behaviors. Rotter (1975) also suggests that different culture may produce different belief on locus of control of reinforcement in a particular situation. He does not regard locus of control as a central concept of the theory but suggests that it can act as a situational/cultural variable, which helps to refine prediction from the theory.

Perception of control over health has gained lots of researchers' interests and the most typical means of control assessment in health-care settings is the application of some measure of locus of control of beliefs (Wallston, 1989). However, locus of control is a very generalized expectancy that may fail to predict behaviors of specific domain, where experience is abundant, because specific expectancies may have been already formed by an individual's sufficient, pervious experience (Wallston, 1989). Generalized expectancies operate predominantly only in novel situations in which an individual has not had formed specific expectancies (Rotter, 1975).

Health is one of the domains where experience is plentiful, especially in adult population and hence, Wallston, Wallston, and DeVellis (1978) developed the Multidimensional Health Locus of Control (MHLC) Scale. However, Harris, Linn, and Pollack (1984) only found significant correlations between other health beliefs like susceptibility to illness and Health Locus of Control but not Rotter's Locus of Control among adult IDDM patients. Their findings add additional support to the notion that the MHLC is a sensitive, specific measure of expectations related to health-oriented behavior.

According to Wallston's modification of Rotter's social learning theory, a person's health locus of control (HLC) orientation is one of several factors that "determines" which health-related behaviors a person will perform. These health-related behaviors, in turn, partially determine a person's health status. Wallston and his colleagues (1978) have found three basically orthogonal dimensions in the MHLC, which are internal (IHLC), external – powerful others (PHLC), and external – chance (CHLC). In other words, the MHLC scale asks people to judge what, and to what extent, controls their health (i.e. the outcomes), while the I-E scale measures people's expectancy that their actions are instrumental to a desired outcome.

Despite being the focus of empirical attention, evidence of an association between different dimensions of health locus of control and health behaviors remains modest and inconclusive (Gillis, 1993; Wallston, 1992). After reviewing the literature of health locus of control and health behaviors, several possible reasons for their non-significant or modest associations were noted.

The first problem relates to the measurement instruments. Though health locus of control is a more specific construct than locus of control, the MHLC scale is still a fairly generalized measure. It is more appropriate to be used to predict global health-related behaviors indices, but not specific behavior or outcomes of that behavior (Wallston, 1992). It has also been suggested that the weak effect of internality on a health domain, such as dietary practice, may be related to its low level of specificity (Wardle, Steptoe, Bellisle, Davou, Reschke, Lappalainen, & Fredrikson, 1997). Further support came from the failure of internal health locus of control in predicting the engagement of single behaviors like smoking, alcohol consumption, eating meat, self-glucose monitoring, attendance of general health screening, and weight loss (Bennett, Norman, Moore, Murphy, & Smith, 1997; Calnan, 1989; Norman, 1991; Norman, 1995; Paxton & Aculthorpe, 1999; Stoller & Pollow, 1994; Weerdt, Visser, Kok, & Veen, 1990). In contrast, the value of IHLC of the MHLC scale was consistently higher when predicting general lifestyle of healthy samples (Duffy, 1988; Duffy, Rossow, & Hernandez, 1996; Norman, Bennett, Smith, & Murphy, 1998; Padula, 1997).

The second possible confounding variable is the population being assessed. In fact, previous studies have suggested that the HLC constructs predicted the health outcomes or behaviors of different populations in different extent. For examples, the HLC constructs were better predictors of doctor visits and health outcomes of the elderly than that of college students (Lachman, 1986). Moreover, Willis and colleagues (1997) also suggested that the significance of perceived control over physical health outcomes might apply less to healthy and socio-economically advantaged older individual, who generally practiced healthful habits, than a vulnerable group. The results of Helgeson's study (1992) strengthened this notion by showing that IHLC was more strongly related to chronic illness adjustment among the patients who perceived greater threat (i.e. with poor prognosis) than those with less threat (i.e. with good prognosis). These findings supported that perceived control is a more important factor of health behaviors or outcomes among the vulnerable individuals like aged people. These people usually have more experience with illnesses and their behaviors are also less restricted by social factors like school, work, and peers, and hence their cognitive control system becomes very influential in health behavior practice. The HLC constructs are expected to significantly account for the certain amount of variance of health habits among vulnerable groups like the elderly outpatients with chronic diseases.

In addition, compared to healthy sample, the lifestyle of vulnerable groups, such as old age people and patients, was influenced by HLC constructs to different extent. Among healthy samples, internals usually was found to perform the most healthful behaviors (Duffy, 1988; Duffy et al., 1996; Norman et al., 1998; Padula, 1997; Seeman & Seeman, 1983; Weiss & Larsen, 1990), while beliefs in control from others or chance were also a significant predictor in some studies (Duffy, 1988; Norman et al., 1998; Seeman & Seeman, 1983). In a study of lifestyle of people aged 55 years or above, it was found that internals still were those who perform more health-promoting behaviors such as exercise and good nutrition (Speake, Cowart, & Pellet, 1989). Among adults with IDDM, those who got lower score on the PHLC scale reported higher frequency of home blood glucose monitoring and variation of nutrition (Weerdt et al., 1990). Moreover, PHLC was found to exert positive effect on health-related behaviors like medical care utilization (Goldsteen & Counte, 1994), but it was not a significant predictor of participation in health-promoting activities in the elderly (Padula, 1997). On the other hand, CHLC was found to be the only significant negative correlate of healthful habits of clients in a nursing clinic (Muhlenkamp, Brown, & Sands, 1985), while both IHLC and CHLC were found to be significant correlates of health-promoting lifestyle of adult ambulatory cancer patients (Frank-Stromborg, Pender, Walker, & Sechrist, 1990). The perception that doctors and significant others control patients' health was also well predicted the self-report adherence behaviors like exercise and taking medication (Meyers & Meyers, 1999). To conclude, these external control orientations are potential influential factors in predicting the health-related lifestyle of the elderly patients.

The target population also influences the choice of measurement instrument of perceived control. The Form A and Form B of MHLC Scale, which predominate in the literature of health-related settings, have been criticized of their applicability on vulnerable groups like chronically ill patients. These persons may have difficulty in responding to the items referred to their "health" as in fact their diseases are more salient to them (Wallston, 1989). With such a given health condition, they may hold different locus of control beliefs about that condition than about their general health status (Wallston et al., 1994). As a result, Wallston and his colleagues constructed the latest version of the MHLC (i.e. Form C) for persons who are under any particular medical condition (Wallston et al., 1994), but it has not been widely used. It is specifically tailored to medical situation but still allows comparison of results across the studies under different disease conditions (Wallston, 1989). Therefore, use of inappropriate measurement instruments can be another possible cause for the inconsistent and modest findings in the previous studies.

Thirdly, ignorance of the effect of health value was also suggested as another major potential deficiencies of previous tests of HLC theory. As Wallston (1991) notes, the majority of research investigated the effect of HLC construct without measuring the value people place on their health. These studies were criticized of their implicit assumption that everyone values their health (Lau, Hartman, & Ware, 1986). Health value is defined as how much an individual values his/her health.

Health value was found to exert individual positive effect on individual or indices of health-related behaviors (Bennett et al., 1997; Kristiansen, 1985; Norman et al., 1998; Weiss & Larsen, 1990; Wurtele, Britcher, & Saslawsky, 1985) but was also not a guarantee (Frank-Stromborg et al., 1990; Muhlenkamp et al., 1985; Norman, 1995; Paxton & Aculthorpe, 1999; Wardle et al., 1997). Moreover, the predictive value of health value to health habits was usually small. The low or even non-significance of health value was suggested to be due to high value skewness (Gillis, 1993).

Researchers suggested that health value acts as a moderator in the association between other health-related cognitions (such as internal health locus of control) and health behaviors, but not directly exerts effect on health behaviors (Conner & Norman, 1996; Wallston, 1992). They have argued that being a moderator, the variable must function as an independent variable, causally antecedent to the criterion variable; and its interaction with the predictor must be significant and more predictive than either predictor or criterion variables alone (Helgeson, 1992; Wallston, 1992).

There was evidence for Wallston's hypothesis that belief in self-control over health is predictive to health behaviors only among people who place high value on health. For example, Weiss and Larsen (1990) showed a significant correlation between internality of control and a health protective behavior index among college students who highly valued health. However, no such correlation existed among those with low health value, though internality was positively correlated with index score for the entire sample. Both internality and health value were found to be associated individually with health protecting behaviors. Similar findings were reported in a longitudinal study of nine healthful behaviors of adults (Seeman & Seeman, 1983) and a survey on dietary practice of European students (Wardle et al., 1997). Another study of college students also demonstrated significant correlation between self-control beliefs (or rejecting beliefs in chance health outcomes) and health preventive behaviors among people who highly valued health only (Lau et al., 1986). On the other hand, inconsistent findings were reported by Wurtele and her colleagues (1985) as well as Norman (1995). They found that the effect of IHLC belief was insignificant on adults' health behaviors like eating sensibly and exercises, regardless of health value.

Some studies demonstrated that the both effect of CHLC and PHLC might also be moderated by health value. A survey on the health behavior index of Wales revealed the moderator effect of health value in relation to PHLC and CHLC but not IHLC (Norman et al., 1998). Furthermore, another recent study supported that the interaction between CHLC and health value was a significant predictor of smoking status (Bennett et al., 1997). Another study on 13,000 people's dietary behavior found that, though three HLC constructs individually correlated significantly ($p < 0.0001$) with certain dietary behaviors, CHLC emerged as the most important predictor (in negative direction), when variation in the value on health was taken into account (Bennett, Moore, Smith, Murphy, & Smith, 1995). However, other studies have indicated that none of the interactions between HLC constructs and health value were found to be significant in the prediction of patients' attendance of general health screening (Norman, 1991).

In summary, the predictive power of HLC constructs is influenced by the target behaviors (whether a specific behavior or a dimension of general health behaviors is measured), the target population, the measurement instrument, and the consideration of the possible moderator effect of health value. These factors are inter-related and thus should be considered concurrently in a study. In addition, in order to increase the predictive power and generalizability of the social learning theory in relation to health behaviors, researchers recommended that further consideration of other cognitive variables such as self-efficacy of performing behaviors should be made (Norman, 1991; Wallston, 1992).

Self-efficacy

Self-efficacy belief is also a necessary component in modifying social learning theory as suggested by Wallston (1992). Wallston has suggested that health-directed actions are most likely to be resulted if an individual concurrently values health as an outcome, has belief that his/her actions influence this outcome, and perceives that he/she is capable to engage in these actions.

In fact, the importance of self-efficacy has long been highlighted in social cognitive theory and it is a crucial determinant of both the initiation and the maintenance of a change in behavior (Bandura, 1997). Self-efficacy belief "represents a generative capability in which multiple sub-skills must be flexibly orchestrated in dealing with continuously changing realities, often containing ambiguous, unpredictable, and stressful elements", while self-efficacy scales assess people's perceived performance capabilities regardless of the anxiety level during the performance (Bandura, 1984). Besides, self-efficacy may not always be situation-specific and can be a generalized belief in various life domains like health (Schwarzer & Fuchs, 1996). As a result, the self-efficacy scale has to be specific enough to a specific behavior or a dimension of behaviors.

In addition to the belief of the facilitative effect of a behavior on one's health, belief that one can perform and maintain the behavior can govern whether he/she engages this behavior through one's self-regulatory mechanism. Perceived self-efficacy was found to be a significant predictor of healthful lifestyle, for examples, among midlife women (Wehrwein & Eddy, 1993) and Mexican American women (Duffy et al., 1996). Furthermore, self-efficacy has been found to significantly predict health behaviors of different dimensions such as physical exercise, nutrition and weight control, and addictive behaviors (e.g. Anderson, Winett, & Wojcik, 2000; Schwarzer & Fuchs, 1996; Schwarzer & Renner, 2000). Among Chinese young patients of IDDM, self-efficacy predicted medical adherence behaviors well (Stewart, Lee, Low, Cheung, Teung, Huen, & O'Donnell, 2000).

Despite distinct predictive power of self-efficacy on health behaviors, Wallston (1992) proposed a moderational role for HLC beliefs in the relationship between self-efficacy and health behaviors. He used the finding of a study on 60 elderly patients who possessed chronic obstructive pulmonary disease (Kaplan, Atkins, & Reinsch, 1984) to support his notion. In this study, the relationship between patients' self-efficacy and their exercise behaviors only held for those who were "HLC internals", but not for "HLC externals". On the other hand, Paxton and Sculthorpe (1999) provided contradictory results on the explanatory power of Wallston's (1992) modified social learning theory on adults' recent attempt of weight loss. However, these studies were not directly comparable in their assessment tools, target population, as well as types of behaviors assessed. Thus, more studies should be done in examining Wallston's new theory, with careful consideration of the specificity of the constructs, population, and behaviors dimension measured.

Previous Research Focus of Effect of Perceived Control on Chronic Illness

In past studies of perceived control of people with chronic diseases, the main focus was the effect of such perception on physical and psychological outcomes (e.g. Affleck, Tennen, Pfeiffer, & Fifield, 1987; Helgeson, 1992; Ma, 1997; Thompson, Gustafson, Gil, Godfrey, & Bennett-Murphy, 1998). For example, Helgeson (1992) observed an inverse correlation between IHLC and adjustment to heart disease. Internal health locus of control was found to be more related to reduced psychological distress for patients with poor prognosis than those with good one. However, there were few studies on the relations between HLC constructs and the health habits of the patients with chronic diseases. Better psychological adjustment to the chronic diseases cannot guarantee a more successful recovery of a patient after discharge if he/she does not participate in healthful habits.

Previous studies on patients with chronic diseases also focused on either their metabolic control or medical regimen compliance, but not their active self-care behaviors (e.g. Bradley, Lewis, Jennings and Ward, 1990; Chrisensen, Wiebe, Benotsch, & Lawton, 1996; Myers & Myers, 1999; Stenstrom, Wikby, Andersson, & Ryden, 1998). Moreover, the metabolic control was usually assumed to totally reflect the adherence to medical regimen without direct examination assessment but literature failed to document such clear direct relationship (for a review, see Johnson, 1992). In fact, the relationship between glycemic control and internal health locus of control is inconclusive. Bradley, Lewis, Jennings and Ward (1990) found that, among NIDDM patients, stronger perceptions of personal control were associated with lower HbA1 levels. However, Stenstrom and his colleagues (1998) failed to find any significant difference among diverse types of believers of control over their illness on metabolic control of IDDM. When collapsing data, it was found that pure internals (high internal but low external control) / believers in control (high internal and powerful other control but low chance control beliefs) have better blood glucose control than those with opposite control orientations (Stenstrom et al., 1998). It was also found that those IDDM patients with worse blood glucose control tended to possess higher level of internal HLC orientation (Peyrot & McMurry, 1985). Another study on IDDM patients observed that those with high diabetes-specific powerful others control belief showed a poor glycemic control (Kohlmann, Schuler, Petrak, Kustner, Krohne, & Beyer, 1993). Not withstanding the above equivocal findings, the causality of these relationships is still unclear.

In fact, glycemic control among patients with NIDDM is the product of their health condition, prescribed medicine and self-care behaviors (Shillitoe, 1988), but not the direct outcome of beliefs. The overall value of locus of control in understanding diabetes mellitus was difficult to be judged at this point of time. Many previous studies, which have given contradictory results, are not directly comparable with their differences in population, target behaviors/outcomes, and assessment tools (Shillitoe, 1988). Some researchers noted that the relationship between self-care behaviors and good metabolic control was not simple and linear (Glasgow, Toobert, Riddle, Donnelly. Mitchell, & Calder, 1989; Mazzuca, Farris, Mendenhall, & Stoupa, 1997). They suggested that it was difficult to isolate clinical outcomes of self-care behaviors from medical treatment effect among NIDDM patients. Moreover, Rost, Flavin, Schmidt and McGill (1990) also found that particular self-care behaviors like blood glucose monitoring frequency were more related to blood glucose control than other self-care behaviors.

Dissimilar to the previous studies, the present research focused on studying the relationships between perceived control of NIDDM patients and their good health habits, which were recommended to general population of the elderly, but not their adherence to medical regimen to control blood glucose level. These habits are believed to have both general health-enhancing and disease/accident-preventive functions. However, the relationship between glycosylated hemoglobin level and health habits practice of the Chinese elderly patients was also explored in the present study as the result might provide insights on the most important habits in metabolic control.

Perceived Control and Chinese Culture

Cultural variation in locus of control has been investigated (e.g. Wrightson & Wardle, 1997). However, it has seldom been evaluated with Chinese populations. Helman (1990) has pointed out the importance of culture on the effect of locus of control over health. For instance, for cultures that assume significant others like family members are responsible to make health care decisions and interventions, people's belief of significant others' control becomes the predominant locus of control. This belief then becomes the main determinant of health behaviors and outcomes. In other cultures, the main control belief may orient to "spiritual or supernatural phenomenon".

Studies have shown that traditional beliefs about control may influence the health habits among the Chinese, especially the elderly. One of such beliefs is fatalism – "future things are for future and whatever will be will be". Fatalistic view is one type of traditional "wisdom" in Chinese culture as attribution to "ming" (fate) may be a denial response to personal responsibility. People who believe the "power of fate" are expected to practise few self-care habits. The concepts of fate and luck are still part of contemporary Chinese, especially elderly, worldview. Hanson's qualitative study (1984) found that fatalism seemed to be involved in the implement of healthful lifestyle practice among Chinese. Fatalistic view has also been found to negatively influence the engagement of health-preventive behaviors of middle-aged Chinese married women (Hoeman & Ku, 1996). However, there were few quantitative studies of Chinese's perceived control effect on their lifestyle. In order to provide implications for health education and promotion, diverse influences of locus of control on implementation of health habits in this distinct population should be investigated.

Chapter 2

Main Study

Purpose of the Present Study

There were many studies testing the usefulness of other health behavior models like Rosenstock's Health Belief Model (1974) in predicting health behavior but it has proved to be modest (Janz & Becker, 1984; Kirscht, 1983). Recently, Pender's Health Promotion Model (1987) and attitude-behavior theory of Ajzen and Fishbein (1980) were commonly used to account for the health behaviors of chronically ill patients. However, the overall variances accounted for by these theories were still not very satisfactory (Frank-Stromborg et al., 1990; Weerdt et al., 1990). In addition, the usefulness of modified social learning theory on explaining health behaviors among patients with NIDDM has not been examined.

The present study made a contribution to social learning theory research by focusing on (a) Chinese elderly out-patients with chronic illnesses; (b) relationships of health locus of control, value on health, self-efficacy, and different tested dimensions of health habits; (c) use of the recently developed form C of the MHLC and behaviors-specific self-efficacy scale. This study also contributes to the future design of health promotion programs for the Chinese elderly.

The present study explored the moderator effects of health value on the relationship between health habits and HLC constructs as well as the moderator effects of HLC constructs on the relationships between health habits and SE. It was specifically hypothesized that, among the elderly patient sample of NIDDM, the product of (1) high belief in IHLC or low belief in CHLC, with either (2) high value placed on health, or (3) high perceived self-efficacy to health habits or both, would a predict higher level of participation in health habits. In social learning terms, it was supposed that those who valued their health and believed their specific health status (i.e. disease prognosis/symptoms) contingent upon their action would be more likely to perform a set of habits within their perceived capability boundaries. Moreover, it was also hypothesized that general health habits would be positively related to physical functioning but not the metabolic control.

In addition, the difference in explanatory power of separated HLC constructs on different dimensions of behaviors of Chinese elderly patients would also be investigated. There were relatively few researches studied this problem. However, the finding of Seeman and Seeman (1983) provided related insights as they found that, among healthy sample, the control belief oriented to luck seemed to predict somewhat better for preventive behavior indices while internal control belief is somewhat better in predicting indices in illness area like bed-days and doctor visits. The results obtained were practically useful for planning of intervention programs for a specific dimension of health behaviors.

Last but not the least, the predictive power of the psychological constructs over health habits among elderly patients were examined across different time points. Very few studies have tested the predictive power of different control beliefs on health habits across time. Seeman and Seeman (1983) conducted a longitudinal study with self-constructed instruments of HLC and HV constructs among healthy sample and they found that their predictive power were quite constant. This knowledge was important in the evaluation of the value of the psychological constructs measured in influencing health habit practice.

Method

Participants

Participants were recruited at two time points. The first wave of participants included 191 Chinese elderly patients (117 males and 74 females) who were recruited from an outpatient diabetes and endocrine center of a large regional hospital (see Footnote 1). The rejection rate was 20%. Participants usually visited the center regularly (about 3-4 months once commonly) and received education and supervision from DM nurses. Elderly patients of the center were eligible for the study if they were above 60 years old and had been diagnosed by the clinicians as having NIDDM, which was defined as with a known history of 3 months or longer. Patients were excluded if they self-reported being functionally dependent or exhibited any organic or psychological problem that would impair their understanding of the questionnaire.

Demographic information of the participants was listed in Table 1. Participants aged from 60 to 88 years, with the mean age being 69.32 (Mean = 64.43 for males, 69.15 for females). About a quarter of them (26.2%) were under 65 years old, 28.3% in the age range of 65 to 69 years, less than one-forth (23%) in the age range of 75 to 79 years, 15.7% in the age range of 75 to 79 years, and about 5% of them aged within the range of 80 to 84 years. Only 3 people (1.6%) were 85 years old or above. Most of them had married (81.2%) and lived with their family (85.3%) but did not have a job (94.7%). About three-tenth of them (29.3%) had not received any or only kindergarten level of education, while those who had attainted primary, secondary, and post-secondary education composed of over two-fifth (44.5%), about one-fifth (19.4%), and less than one-tenth (6.8%) of the elderly sample respectively. Participants' monthly family income were quite evenly distributed: About 20.9%

below HK$4,000, 28.8% between HK$4,000-9,999, 25.2% between HK$10,000-19,999 and 17.8% higher than $20,000. About two-fifth of the participants (40.8%) did not have any religious affiliation and another two-fifth reported that they only believed in traditional Chinese Gods like Wong Tai Sin. About 8% of them worshiped ancestor, 3% affiliated to Buddhism/Taoism and 7% reported to be Protestants or Catholics.

Insert Table 1 about here

Table 2 showed the medically related information of the elderly participants. Participants were more or less evenly distributed across categories of duration for their disease. The mean duration was 9.70 years (SD = 7.64) for all participants, with 9.23 years for males and 10.47 years for females. A slightly higher proportion of them (25.3%) reported to have NIDDM for more than 10 years but less than 15 years. Most of them had visited the center for less than 10 times (71%) and took medicine as treatment (50.8%).

There were no gender differences found in age, family income, employment status, and living arrangement ($p > .05$). However, more females than males were widowed or separated with their husband ($\chi^2(3) = 15.48$, $p < .001$). It is understandable as females usually have longer life expectancy than males (Hong Kong Department of Health, 1997/98). The educational attainment of females was generally lower than that of males among this elderly sample ($\chi^2(3) = 30.54$, $p < .001$). Less than half of the female participants (48.6%) attained at least kindergarten or higher educational attainment. Moreover, more female participants had religious affiliation and 63.5% of them believe in traditional Chinese Gods. In addition, female and male samples were not different in their DM history, treatment types, as well as number of visits to the DM clinic.

Insert Table 2 about here

In the second wave, 148 participants (77.5%) from the first wave completed the follow-up questionnaire 6 months later. The reasons of dropout were as follows: death (2%), no phone number given (4.1%), lost contact due to wrong number, or long distance call number etc. (12.3%), and refusal to participate due to health reasons like hearing problem (4.1%). Dropout analysis showed that the longitudinal sample was not different from the dropout sample in any demographic aspects, with exception for educational level (χ^2 (3) = 12.586, $p < .01$). Higher proportion of people with low education (none/kindergarten) was found in the dropout sample (51.2%) than in the longitudinal sample (23.1%).

Instruments

Health habits. Twenty-seven items were chosen to represent the domain of common health-relevant habits from the original 40-item Health Behavior Checklist (Vickers et al., 1990) and the 48-item Health-Promoting Lifestyle Profile (Walker et al., 1987). The items were chosen according to whether they were behavioral in nature and elderly patient-specific. Items of both Self-actualization and Interpersonal Support subscales (e.g. “being enthusiastic/optimistic” and “enjoy touching”) and items like “doing vigorous exercise” were deleted according to the criteria above. In total, 61 items were deleted from two scales. The selected habits were generally believed to be healthful to the elderly who has sufficient capability to take care themselves, despite their clinically identified diseases like diabetes mellitus.

Each participant was asked to indicate how well the specific health habits described his/her typical behaviors. Responses options were on a four-point Likert scale ranging from "strongly agree" to "strongly disagree". A health habit index for each participant was calculated as the mean of all item scores, with a high score represented a higher level of healthful habits practice.

Health locus of control. Form C of the MHLC Scales (Wallston et al., 1994) was used as a measure of the elderly participants' beliefs regarding the types of control over their health outcomes. It is condition-specific (i.e. disease-specific) and composed of four sub-scales: six items for internal health locus of control (IHLC), six items for chance health locus of control (CHLC), three items for doctor health locus of contro (DHLC), and three items for others health locus of control (OHLC). This form has been used among different patients samples and Cronbach alpha reliabilities of these sub-scales were about .85 for IHLC, .80 for CHLC, .70 for DHLC, and .70 for OHLC (Wallston et al., 1994). All sub-scales also possessed acceptably high concurrent and construct validity (Wallston, et al., 1994). Another similar version to the currently used scale is Form A of the MHLC Scales (Wallston, Wallston, Kaplan, & Maides, 1976), which has shown satisfactory internal reliabilities in Chinese patients with psychiatric illness, i.e. .65 for IHLC, .68 for CHLC, .49 for PHLC (Mak, 1999), as well as for patients with DM, i.e. .66 for IHLC, .71 for CHLC, .74 for PHLC (Ferraro, Price, Desmond, & Roberts, 1987). The scale score of each HLC constructs for any participant was calculated as the mean of the all subscale item scores. High scores in IHLC, CHLC, OHLC, and DHLC represented high level of control orientation of health belief to self, chance/fate, significant others, and doctors respectively.

Health value. A four-item scale was used to assess the extent of a person's value put on health. It was also been used by Norman (1995), who found its reliability (alpha) being .69. However, the items were modified from question statements to narrative ones and the participants were asked to respond in the four-point Likert scale format ("strongly agree" to "strongly disagree") for easy administration and response. The health value score was calculated as the mean of the item scores. A high score represented a high value of health one perceived.

Self-efficacy. It is a scale modified from a 6-item scale that originally assessed "self-efficacy towards healthy eating behavior" (Fuchs, Leppin, Schwarzer, & Wegner, 1993). The wording and meaning of "healthy eating behaviors" in the items were changed into "health habits mentioned above" in order to increase the specificity of the scale to "health habits". Participants responded in four-point Likert format, from "strongly agree" to "strongly disagree" to the statement. Participants' self-efficacy was calculated as the mean of the item scores, with high score representing high self-efficacy.

Health status. The Chinese (HK) version of the SF-36 Health Survey (Lam, Gandek, Ren, & Chan, 1999) was used to assess the health-related quality of life in the present study. The SF-36 is widely used cross-culturally and has been tested and translated in more than 40 countries. It taps eight aspects of quality of life, including, physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). Lam and her colleagues have shown the validity and reliability of the Chinese (HK) SF-36 and, at present, the SF-36 is the only measure about health-related quality of life that was both validated and normed on the general population in Hong Kong (Lam et al., 1998; Lam, Lauder, Lam, & Gandek, 1999). The scale score of each scale was transformed into standard score range from 0 to 100 for a clear comparison among scales. The transformation formula is "(raw scale score – lowest possible scale score) / possible raw score range * 100 ". As the scale scores measure eight unique domains, they are not recommended to form an index score by simple summation. A high score in a scale represented that the elderly participant functioned well in the corresponding aspect.

Blood glucose control. Glycosylated hemoglobin (HbAlc) test is routinely used for clinical purposes and is the most widely used measure of diabetic control in the research literature (Cox & Gonder-Frederick, 1992). It is an absolute indicator of diabetes management, independent of variables like the time of day, recency of meals, and exercise which influence other blood glucose measures (Shillitoe, 1988). It is used in long-term monitoring of glycemic control and repeated request of testing within 8 weeks will not be processed by the hospital laboratory. With financial and technical constraints, an immediate HbAlc was not possible in the present study, but the laboratory results at the most proximal time of the initial interview (within +/- 8 weeks) were obtained through computerized hospital records. The range of normal values for this method is 5.1-6.4 but the range for elderly patients with NIDDM is usually less restricted. A subject was classified as poor control if his/her HbAlc was 7.6% or greater, and as good control if HbAlc was below 7.5%. The cutoff point was chosen to produce more or less equal group size of subjects and does not represent a clinical judgment.

Demographics. Participants were be asked about their age, gender, marital and working status, monthly family income, education level, religious affiliation, duration and treatment of diseases as well as number of visits to the center.

Procedures

The outpatient clinic nurses referred their healthy elderly members who were aged 60 years or over and diagnosed with NIDDM. Participants were interviewed individually in the clinic. Assurances that confidentiality of their responses would be maintained were given. Participants were informed that they could withdraw from the interview anytime they wanted to. Cardboards with answer choices were given to assist their responses. The interviewer read the questionnaire to the participants and recorded their verbal or behavioral responses. Each interview took an average of about 40 minutes to complete. No monetary reward was given to the participants. Participants' consent of participating in the study was obtained by the interviewers directly before the interview. This study also obtained ethical approval from the Clinical Research Ethics Committee of the university.

At Time 1, participants were administered with the full questionnaire, which included the 27-item health habits checklist, the MHLC scales, health value scale, self-efficacy scale, SF-36, as well as questions of demographics. Participants' identity card number and telephone number were also asked for checking their recent blood glucose test record as well as half-year follow-up respectively. After 6 months from the initial interview (Time 2), a telephone interview was made. Only their health habits as well as health status were assessed at this time point. Completed questionnaires and data were destroyed after the study was completed.

Data Analysis

Statistical analysis was performed using the Statistical Package for Social Science (version 10.0) software on an IBM compatible computer. As most of the instruments were developed with normal population, their psychometric characteristics like reliabilities were also assessed with the present sample of Chinese elderly patients with DM.

In the first part of the study, exploratory and confirmatory factor analysis was performed on the selected items of Health Habits Checklist in order to determine the number of dimensions among these habits. T-tests, ANOVA, and correlation analyses were conducted in order to reveal the preliminary relationships among all psychosocial variables. The impacts of demographic variables were also explored and those with significant results were further tested in the subsequent analyses.

Then, hierarchical regression analysis was performed to test whether the HLC constructs acted as moderators of self-efficacy and health value in influencing health habits assessed at Time 1. In this procedure, enter method was used and the significance of the interaction terms of these factors on health habit practice was tested. All interaction terms were standardized by standardizing their components through separately subtracting from their own mean before multiplication. However, if the blocks of interaction terms were found to be non-significant, further multiple regression analyses (stepwise method within block) were used to identify the most predictive psychological factors.

In the multiple regression analyses, the first block consisted of significant demographic and medical variables, which were age, gender, religious affiliation (4 dummy variables), education, and physical functioning. Physical functioning in SF-36 was regarded as more objective indicator of one's physical health status and it would also highly correlate with general health as reported by the participants in the present study. These influences of variables on health habits were controlled in this way before the main effects of the psychological variables were tested. The second block were the main effects of the HLC constructs, health value (HV), and self-efficacy (SE), while the third block contained IHLC*HV, CHLC*HV, PHLC*HV, IHLC*SE, CHLC*SE, aş well as PHLC*SE. The final block consisted of a three-way interaction IHLC*HV*SE only.

Results

Results for the First Wave Data

All scales showed satisfactory high internal consistencies, their standardized alpha ranged from .6384 to .9356 (Table 3).

Insert Table 3 about here

Analysis of Demographic Information

In order to investigate the demographic effect on health habits, independent sample t-tests, ANOVAs, and correlation analysis were conducted. Results were summarized in Tables 3 and 4. T-tests results showed that there was no gender difference in habits practice ($p > .05$). Religious affiliation was the only demographic variable found to exert significant influence on health habits ($F(4,186) = 2.890$, $p < .05$). The mean of health habit index for ancestor group, Chinese Gods group, Buddhists/Taoists, and Christian/Catholic and antitheists were 2.82, 2.93, 3.02, 3.13 and 2.88 respectively. Turky HSD tests were also carried out for post hoc pairwise comparison of means and indicated that those being Protestants/Catholics reported significantly more healthful habits as compared to those having no religious affiliation or worshiping ancestor ($p < .05$).

Insert Table 4 about here

Similar statistical procedures were conducted to investigate the relationship between demographic variables and psychological constructs. Results of t-tests revealed that female participants possessed significantly higher level of health value and CHLC than males ($t(189) = -2.00$ and -4.59 respectively, $p < .05$). On the other hand, educational level and religious affiliation were related to CHLC belief ($F =$ 9.242 and 4.539 respectively, $p < .01$; Table 4). The mean CHLC scale scores of participants with kindergarten, primary education, secondary education, and post-secondary education were 2.80, 2.54, 2.21 and 1.96 respectively (Spearman correlation = -.362, $p < .000$). That is, the more education an individual received, the less the belief on chance health orientation. On the other hand, the CHLC scores of ancestor group, Chinese Gods group, Buddhists/Taoists, and Protestants/Catholics (Western) and antitheists were 2.38, 2.74, 2.22, 2.60 and 2.31 respectively. Post hoc comparisons showed that those who believed in Chinese Gods also tended to believe more in fate/chance determination on health than people without any religious affiliation ($p < .001$). Also, compared to participants without religious affiliation or Christians/Catholics, the Chinese Gods believers attained lower education level ($F(4, 185) = 6.64$ and Post-hoc Turkey Test, $p < .05$). These findings might help to explain why females reported higher CHLC scale score as most of them had lower educational attainment and worshiped Chinese Gods.

Age was negatively correlated with the internality of health control of the elderly participants ($r = -.217$). In other words, older participants tended to report a lower level of internal health locus of control. Lastly, people with different living arrangement oriented to OHLC to different extent ($F(2,188) = 8.779$, $p < .001$). Those participants who lived alone (Mean score = 1.76) were less likely to adopt a belief of family control over one's health than those lived with the family or in the institution (Mean score = 2.51 and 2.25 respectively).

With regard to health status, MANOVA was also run to explore the demographic effects over several domains of health-related quality of life. Gender difference was shown to be marginally significant in overall health-related quality of life (Wilks' Lambda = .991, $p = .074$). Results of ANOVAs showed that males seemed to report a better quality of life as males had significantly better physical functioning (PF), less role limitation due to physical problem (RP), better health in general (GH), higher level of vitality (V), and better mental health (MH) ($p < .05$; Table 4).

Results of MANOVA showed no significant differences across different religious (Wilks' Lambda = .855, $p > .05$) as well as educational groups (Wilks' Lambda = .890, $p > .05$). However, family income was found to associate with health-related quality of life in general as reflected by the MANOVA results (Wilks' Lambda = .626, $p < .05$). Univariate tests showed that family income was related to role limitations due to both physical (RP) and emotional reasons (RE) (Table 4). The lowest income group (i.e. below HK$2000) tended to report more role limitation (mean RP score = 42.86 and mean RE score = 47.62) than other groups whose mean RP score and RE score ranged from 67.74 to 87.04 and 68.33 to 88.10 respectively.

MANOVA also showed that the number of clinic visits did not associate with quality of life in general (Wilks' Lambda = .837, $p > .05$), while significant treatment effect was found on quality of life (Wilks' Lambda = .791, $p < .05$). Treatment type was related to not only physical functioning ($F(3, 187) = 2.769$, $p < .001$) but also age ($F(3,187) = 4.19$, $p < .01$) (Table 4). Results showed that older participants who were more likely to receive insulin treatment, also reported poor physical functioning.

Age had inverse correlations between PF score ($r = -.404$) and BP score ($r = -.224$). That is, older participants reported worse physical functioning as well as more body pain than younger participants. Body pain was also found to be related with diabetes duration ($r = -.177$) and number of visits to the DM clinic ($F(3,187) = 3.414$, $p < .05$) (Table 4). DM duration was positively associated with age ($r = .163$, $p < .05$). It seemed that with advancing age, people have longer history with DM as well as more physical bodily pain complaint.

In summary, being Protestants/Catholics appeared to be a significant determinant of general health habits practice. Compared to males, females put more value on health and believed more the chance health locus of control, and reported poorer health-related quality of life. Internality of health control was negatively correlated with age, while belief of significant others controlling health was related to living arrangement. Those who believed in Chinese Gods also reported a higher level of chance - control orientation over health. Older participants, compared with their younger counterparts, were more likely to have longer DM duration, receive insulin treatment, and reported poorer physical functioning and bodily pain. Extremely low-income group also reported more severe role limitation, compared with other income groups.

Analyses of Blood Glucose Control

T-tests were conducted to examine whether there were anthropometric group differences on general health habits and psychological variables. From Table 3, no significant differences on health habit index, IHLC, CHLC, and OHLC were noted between good and poor glucose control groups ($p > .05$). However, people with good blood glucose control believed more in doctor's control over their health than those of poor control group (mean = 3.57 and 3.43 respectively; $t(178) = 1.97$, $p < .05$).

MANOVA was used to check whether the two blood glucose control groups differed in their health status. The multivariate tests result suggested that these two groups were not significantly different in difference aspects of quality of life, including physical functioning and general health (Wilk's Lambda = .966, $p > .05$). Separated domain-specific t-test results were presented in Table 3.

Lastly, the blood control group differences on demographic or medical variables were tested by ANOVA and crosstabs analysis. The good and the poor glucose groups did not differ in gender, age, family income, religion, education level, number of visits to clinic, and DM duration ($p > .05$), but they were different in treatment type ($\chi^2(3) = 16.93$, $p < .005$). About equal size of the sample of having medicine treatment belonged to good (53.9%) and poor control groups (46.1%). However, there were 76.9% of those who had exercise and diet as treatment belonged to good blood glucose control, while 61.5% of those receiving insulin and 85.7% receiving both medicine and insulin were classified into the poor glucose control group. In other words, those who failed to control blood glucose level through exercise, diet and medication (i.e. poor prognosis) were more likely to receive insulin injection or a combined treatment of medication and insulin.

Similar procedures were replicated to compare participants in the upper-third and the lower-third quartile of blood glucose control and comparable results were obtained with the only exception in the HLC scale scores. The participants of the upper-third group of blood glucose control believed in less significant-others oriented health control (mean = 2.17, SD = .81) than those of the lower-third group (mean = 2.60, SD = .84) ($F(1, 83) = 5.788$, $p < .05$) but they had no significant difference in DHLC. Because the results of the good and poor glucose control groups formed by median split were representative enough, the comparison results of upper-third and lower-third groups of glucose control were not reported here to reduce redundancy.

In sum, good and poor blood glucose control can be best differentiated by treatment type. Elderly participants who received insulin injection or a combined type of treatment were more likely to have poor control in their blood glucose level.

Factor Analyses of Health Habits

Results on the health habits endorsement pattern showed that Hong Kong elderly participants with diabetes generally had a healthful lifestyle. Their mean health habit index was 2.92 (SD = .30) out of 4, and their levels of endorsement of practicing many health habits were also very high (Table 5). However, it should be noted that few participants engaged in several preventive health habits like regular dental check (20.4%), discussing health issues with others (47.4%), and participating in health care programs (22.2%).

Insert Table 5 about here

In order to explore how many dimensions underlying the healthful habits of the elderly participants, exploratory factor analyses with Oblimin rotation were performed. The result of Scree Plot suggested two factors and thus the following analyses were fixed to two factors. The resultant factors were defined as "diabetes-related habits" (Factor 1, F1) and "preventive health habits" (Factor 2, F2), which respectively accounted for 18.59% and 7.26% of variance in health habits. Only items with factor loading greater than .35 were considered as significant factor components. Two items (i.e. destroy old medicine and express feeling) were deleted from the factors because of their low communalities. Moreover, the factor components were also meaning-driven. If an item was double-loaded on two factors, it was assigned to the meaning-consistent factor. For example, item of "checking first aid box regularly" had double loadings on the two factors but was assigned to the second factor as its meaning is more preventive in nature. Item 1 (exercise) and 7 (emergency numbers), which had factor loading lower than the criteria set but coherent to the factors in meaning, were kept in the resultant factors. Though the first factor was generally composed of those habits which helped to improve participants' medical condition, there were five meaning-non-congruent items (e.g. not take harmful chemicals, brush teeth, have pleasant bedtime thought, and stay away from pollution, or germ) loaded on this factor. These items were also deleted in order to keep the meaning of the component in congruence.

Another exploratory analysis was performed in the remaining items and the result suggested the deletion of one additional item (i.e. avoid over-the-counter medicine) due to its low communality in this factor solution. Final exploratory factor analysis was performed and resulted in two factors which explained a total of 29.94% of the variance in the health habits (diabetes-related habits – 21.04% and preventive health habits – 8.90%). The resultant factors and loadings were shown in Table 5. There were a total of 19 items left after final factor analysis, with 11 items for Factor 1 (diabetes-related habits) and 8 items for Factor 2 (preventive health habits). The two factors demonstrated satisfactory internal consistencies (alpha = .73 and .64).

Analysis of Demographic/Medical Effects on Two Health Habits Dimensions

Similar to the analysis of general health habits, t-tests, ANOVAs and correlation analyses were conducted to test the relationships between the demographic as well as medical variables and two health habits. Diabetes-related habits did not correlate with any demographic factors, while preventive health habits were influenced by age, educational attainment, and religious affiliation (Table 4). Results showed that with advancing age, people tended to engage in less preventive health habits (r = -1.92). Moreover, engagement in preventive health habits varied across educational attainment groups ($F(3, 187)=8.68$, $p < .001$). The mean preventive health habits scores of kindergarten, primary, secondary, and post-secondary level were 2.19, 2.47, 2.56, and 2.63 respectively. Results indicated that preventive health habits increased with higher educational attainment (Spearman correlation = .337, $p < .001$). Moreover, there were differences among various religious affiliations in preventive health habits practice ($F(4, 186) = 2.612$, $p < .05$) and marginally significant difference in diabetes-related habits ($F(4, 186) = 2.331$, $p = .058$). The means of preventive health habits for antitheists, ancestor group, Chinese Gods group, Buddhists/Taoists, and Protestants/Catholics (Western) were 2.42, 2.31, 2.37, 2.65, and 2.71 respectively while their means of diabetes-related habits were 3.12, 3.12, 3.21, 3.18, and 3.41 respectively. Participants who believed in Christianity/ Catholic performed more preventive health habits, compared with those who believed in Chinese Gods ($p < .05$ by Turky test). On the other hand, elderly participants who were Christianity/ Catholic also reported more diabetes-related habits, compared with those without religious beliefs ($p < .05$ by Turky test). Similar to the results of general health habits, people believed in Western religions were more likely to perform healthful habits.

The good and poor blood glucose control groups did not differ in their preventive health habits but marginally significantly differed in diabetes-related habits ($t(173) = 1.94$, $p = .055$). The good HbAlc control group tended to report more diabetes-related habits than the poor control group did (Table 3).

In sum, different patterns of effects of demographic or medical variables emerged in diabetes-related habits and preventive health habits. It was found that diabetes-related habits were not influenced by these variables. In contrast, preventive health habits were associated with several demographic variables. Participants who were younger, have higher educational attainment, and believed in Buddhism/Taoism or Christianity/Catholic were more likely to report more preventive health habits.

Correlations among Psychological Variables and Health Habits at Time 1

In order to understand preliminarily the inter-correlations among the psychological and health habit variables, their correlations were analyzed. Table 6 demonstrated the correlation matrix of psychological variables assessed at Time 1. The subscales of the SF-36 scale were almost all significantly correlated with each other. On the other hand, self-efficacy, health value, and IHLC scale scores were positively correlated with each other. IHLC scale score also positively correlated with DHLC and OHLC, while CHLC scale score was negatively correlated with self-efficacy. Furthermore, those with less belief in doctor's control over health (i.e. higher DHLC scale score) tended to value health to a larger extent.

Insert Table 6 about here

Regarding health habit dimensions, health habit index was positively correlated with health value, self-efficacy, internal health locus of control, as well as doctor health locus of control. In other words, Chinese elderly participants who valued their health, were confident of their ability to practice various health habits, and viewed their illness as controllable by both doctor and themselves were more likely to engage in general healthful habits. On the other hand, health habits index was positively correlated with quality of life especially in physical functioning, role limitation (physical), vitality and mental health. Participants who reported more general health habits were more likely to be physical and mental healthier with more vitality and less role limitation due to physical reasons.

Similar pattern of correlations was observed between diabetes-related habits and psychological variables. However, distinct correlates of preventive health habits were found. Preventive health habits were associated not only with self-efficacy, health value, and internal health locus of control, but also chance health locus of control and others health locus of control. In other words, participants who valued their health, were confident of their ability to practice preventive health habits, and viewed their illness as controllable by both doctor, significant others, and themselves but not by chance or fate, were more likely to engage in preventive health habits. Both diabetes-related and preventive health habits were positively correlated with physical functioning but preventive health habits were also affirmatively correlated with vitality.

Within the domain of health-related quality of life, both physical functioning and vitality were positively correlated with self-efficacy, health value and internal control orientation, but negatively with chance control orientation. General health was also positively associated with self-efficacy and negatively with chance health locus of control. Mental health and role limitation due to physical problems were correlated with self-efficacy and internal control orientation respectively. Bodily pain was related to doctor health locus of control, while both role limitation due to emotional problems and social functioning were correlated with others health locus of control.

Regression Analyses of General Health Habits at Time 1

Through correlation analysis, the inter-relationships among variables were generally known. Yet, the predictive values of variables, when taking common variance among them into account, on health habits were still unknown. Moreover, the Wallston's modified social learning theory could be tested by examining the predictive powers of the interaction terms formed by health value, self-efficacy, and HLC constructs. As a result, regression analysis was used to test both the main and moderator effects of different variables on predicting health habits.

A preliminary hierarchical regression analysis with enter method was performed. Results showed that the block of interactions between HLC constructs and HV or SE was statistically non-significant (F change (8, 165) = 1.73, $p > .05$). Three-way interaction (IHLC*HV*SE) was also not significant (F change (1, 164) = .115, $p > .05$) in predicting health habits index. Same findings were replicated in both male (F change (8, 92) = 1.73, $p > .05$; F change (1, 91) = .55, $p > .05$) and female samples (F change (8, 52) = .91, $p > .05$; F change (1, 51) = .44, $p > .05$). As a result, in the subsequent analyses, interaction effects (IHLC*HV, CHLC*HV, DHLC*HV, OHLC*HV, IHLC*SE, CHLC*SE, DHLC*SE, OHLC*SE, and IHLC*HV*SE) were not further considered.

To simplify the model, the non-significant blocks of interaction terms were deleted and further multiple regressions was run to test the predictabilities of the main effects of different psychological variables. By the stepwise method, any variable with significant F change ($p < .05$) would enter into the model. It must be noted that the block a variable belonged would affect its sequence of being considered by the statistical program. In general, demographic and medical variables were entered as the first block in order to control their effects, if any. They were age, gender, religious affiliation (4 dummy variables), education (as a continuous variable), and physical functioning. These demographic were found to be associated with health habits in the previous analyses. Subsequent block was psychological variables (second block).

The model of health habit index was presented in Table 7. By stepwise method, physical functioning, among all demographic factors, was first entered significantly into the model. Its positive standardized coefficient (beta = .229) indicated that patient's physical functioning increased with health habits practice. Then, the dummy variable of religious affiliation (Christianity/Catholicism) entered the model and its positive beta (.177) showed that, compared with antitheists, Christians/Catholics engaged in more health habits. No more variables in block 1 were selected to enter into the model.

Insert Table 7 about here

Among the variables in block 2, self-efficacy, health value, doctor health locus of control and internal health locus of control were entered into the model consecutively. They all had positive standardized coefficients, which demonstrated that an increase in any of these variables led to an increase in general health habits. Moreover, no interaction of any variables significantly entered into the final model. In total, 47.3% of the variance of the health habit index was explained by this model.

One should note that physical functioning at Time 1 and religious affiliation initially showed a significant relationship with health habit index but lost their significance in the later stage when the psychological variables were entered into the equation. This finding revealed that the physical functioning was not essential consideration of general health habit practice, when psychological variables were considered.

Besides, as male and female participants reported different level of beliefs as well as health status at Time 1, further regression analyses were done to explore whether gender act as another potential moderator of the main predictors on influencing health habit index. From the correlation matrices (Table 8), males and females showed some differences in significant correlation with habits. However, these differences might be due to the difference in sample sizes. Therefore, another hierarchical regression analysis (i.e. by enter method) was performed. In the first block, gender was the only demographic variable entered. In the second block, psychological variables like SE entered while the third block contained the interaction terms formed by gender and psychological variables (i.e. gender*IHLC, gender*CHLC, gender*DHLC, gender*OHLC, gender*SE and gender*HV). Results showed that the interaction block was non-significant in predicting general health habits ($\underline{F}$ change $(6, 177) = .950$, $\underline{p} > .05$). As a result, no gender moderator effects were considered in subsequent analyses.

Insert Table 8 about here

<u>Regression Analyses of Diabetes-related and Preventive Health Habits at Time 1</u>

In order to provide more information when a specific approach was adopted in health promotion program for the elderly, the psychosocial correlates of two underlying factors of health habits found in the present study were further analyzed. By the hierarchical regression analysis with enter method, it was found that the block of interactions between HLC constructs and HV or SE was statistically non-significant in the models of both diabetes-related habits (F change (8, 165) = 1.946, $p > .05$) and preventive health habits (F change (6, 165) = 1.318, $p > .05$). Three-way interaction (IHLC*HV*SE) was also not significant in predicting neither diabetes-related (F change (1, 164) = .688, $p > .05$) nor preventive health habits (F change (1, 164) = 2.761, $p > .05$).

To simplify the model, the non-significant blocks of interaction terms were deleted and further multiple regressions (stepwise method) was run to test the predictive powers of the main effects of different psychological variables. Regarding diabetes-related habits and preventive health habits, different significant predictors were found (Tables 9 and 10).

Insert Tables 9 and 10 about here

Age, gender, educational level, religious affiliation and physical functioning were entered into the block 1 of the model of both dimensions. As expected, education made a significant F change and a positive beta (beta = .317, $p < .05$) to the model of preventive health habits but not that of diabetes-related habits. In other words, preventive health habits increased with the increase in educational level. Similar to the regression model of general health habits, physical functioning and Western religion affiliation was entered only into the models of diabetes-related and preventive health habits. Their positive standardized coefficients suggested that those participants with better physical health or being Christians/Catholics engaged in more diabetes-related habits. However, these two demographic variables, again, lost their significance ($p > .05$) when health value and perceived control constructs were entered into the models of two dimensions of health habits.

In block 2, both diabetes-related dimension and preventive dimension of health habits increased with health value and self-efficacy. However, DHLC predicted only the diabetes-related habits, while IHLC predicted preventive health habits. Participants, who put more value on health, had higher self-efficacy, and believed in doctor's control over their health, tended to report more diabetes-related habits. Similarly, those with higher health value, self-efficacy, as well as internal health locus of control, were more likely to engage in preventive health habits. Educational attainment was the only demographic variable that remained statistically significant after psychological variables were entered into the model. These two finalized models respectively accounted for 40.5% and 32.0% of the variance of diabetes-related habits and preventive health habits.

Further regression analyses were done to explore whether gender acted as another potential moderator of the main predictors on influencing diabetes-related habits as well as preventive health habits. Another hierarchical regression analysis (i.e. by enter method) was performed. Similar to the procedure carried out in health habit index, gender was the only demographic variable entered in the first block. In the second block, psychological variables like SE were entered while the third block included the interaction terms formed by gender and psychological variables (i.e. gender*IHLC, gender*CHLC, gender*DHLC, gender*OHLC, gender*SE and gender*HV). However, the interaction block was found to be non-significant in predicting not only diabetes-related habits ($\underline{F}$ change $(6, 177) = 1.072$, $\underline{p} > .05$) but also preventive health habits ($\underline{F}$ change $(6, 177) = .692$, $\underline{p} > .05$). As a result, gender moderator effect was considered in subsequent analyses of these two dimensions of habits.

To recapitulate the regression results, the main effects of the psychological variables, but not their moderator effects, explained the health habits very well. Both health value and self-efficacy are the most salient factors. Though some demographic variables appeared to be useful predictors, most of them lost their significance when psychological variables were taken into account.

Results for Second Wave Data

Correlations of Health Habits/Health Status at Time 1 and Health Status at Time 2

In Table 11, it was observed that general health habits reported at Time 1 was significantly correlated with physical functioning, role-taking competence (physically), general health vitality, and mental health at Time 2. Moreover, all aspects of health-related quality of life at Time 2, except bodily pain, increased with the practice of diabetes-related habits at Time 1. Preventive health habits at Time 1 were only correlated with physical functioning at Time 2.

Insert Table 11 about here

Table 11 also showed the correlations between health status at Time 2 and other psychological variables. The correlation patterns of health status at Time 2 and self-efficacy or health value were similar to that at Time 1 (Table 6). Self-efficacy was not only positively correlated with quality of life at Time 2 in physical functioning, general health, vitality and mental health, but also role-taking competence (emotional). On the other hand, only physical functioning increased with an increase in health value. With regard to the HLC constructs, IHLC was still a significant positive correlate with quality of life at Time 2, whereas CHLC was a negative correlate with quality of life at Time 2. DHLC and OHLC did not correlate with any domains of quality of life at Time 2. All domains of quality of life at Time 2 were correlated with that at Time 1 favorably.

In addition, the intra- and inter-correlations among health habits and health status measured at Time 2 were shown in Table 12. More significant correlations were observed between health habits and health status at Time 2 than at Time 1 (Table 6). For example, general health habits at Time 2 were found to positively correlate not only with physical functioning, role-taking competence, and vitality, but also general health and social functioning reported at Time 2. In addition, diabetes-related habit practice at Time 1 was correlated with physical functioning at Time 1 only but diabetes-related habits at Time 2 was also correlated with general health, vitality, social functioning and mental health at Time 2. All domains of health-related quality of life at Time 2 were significantly correlated to each other.

Insert Table 12 about here

Changes across Time

In order to investigate the change in health habits and health status in six months period, MANOVA with repeated measure was performed (Table 13). As males and females showed significant differences in several aspects of health status, gender was chosen as a between factor in the analysis in order to explore any interaction effects. There was no main (i.e. time and gender) or interaction effect (time*gender) in the health habit index or its sub-dimensions was shown in results of ANOVA ($F(3,144) = .273$, 2.014 and 2.967 respectively, $p < .05$).

Insert Table 13 about here

Significant time and gender effects but no interaction effect (time*gender) on domains of quality of life were noted (Wilks' Lambda = .821 and .883 while $F(8,130) = 3.541$ and 2.160 respectively, $p < .05$). Both physical functioning and mental health was found to reduce from Time 1 to Time 2 ($F(1,137) = 8.876$ and 14.911 respectively, $p < .01$). Moreover, as there was no significant interaction effect observed, the between-factor effect of gender in physical functioning, body pain, general health, vitality and mental health could be interpreted as that male elderly participants were healthier than female ones in these aspects of quality of life across that period of time.

Though the habit change across time was not significant, the imperfect correlations ($r \neq 1.00$) indicated the existence of intra-individual variation. In order to further investigate what accounted for the variation, the data were processed by regression analysis.

Stepwise Regression Analysis of Health Habits at Time 2

The significant predictors of health habits index at Time 2 were found by regression analysis (Table 14). The statistical procedures were similar to the regression analysis of health habits at Time 1, but physical functioning at Time 2 was entered instead of that at Time 1. Moreover, health habit index at Time 1 was entered into the model as block 2 after the contribution of demographic and medical variables were examined.

Insert Table 14 about here

By the stepwise method, among all demographic and medical factors, physical functioning at Time 2 was first entered into the model (beta = .211, $p < .05$). This result was similar to the regression analysis of Time 1 and demonstrated that patient's physical functioning increased with health habits practice. Next, the dummy variables of religious affiliation related to Christianity/Catholicism (beta = .202, $p < .05$) and Chinese Gods (beta = .244, $p < .05$) consecutively were entered the model. Compared to those without religious affiliation, both Protestants/Catholics and believers in Chinese Gods engaged in more health habits than antitheists. No more variables in block 1 further entered into the model.

Subsequently, health habit index at Time 1 was entered into the model and it accounted for 47.5% of variance of health habits index at Time 2. After that, self-efficacy was the only variable, among the psychological variables of block 3, entered into the model consecutively. Its positive standardized coefficients (beta = .145, $p < .05$) showed that self-efficacy assessed at Time 1 was positively correlated with health habits practice at Time 2, even controlling the demographic variables as well as habits at Time 1. People with high belief on their capability of performing health habits tended to report more healthful habits at Time 2. The standardized coefficients of physical functioning and affiliation to western religion became non-significant when the health habits at Time 1 and self-efficacy were considered in the model. The finalized model accounted for 63.1% of variance of health habit index at Time 2 (Table 14).

Regarding to the two dimensions of health habits, affiliation to western religion and Chinese Gods, physical functioning, as well as habits assessed at Time 1 were still significant variables to predict habits ($p < .05$)(Table 15 and 16). These results were consistent with that of health habits index at Time 2. Educational level was also significantly predictive to preventive health habits (beta = .353, $p < .05$). People with higher education engaged in more preventive habits at six months later. Moreover, no psychological variable entered into the model of preventive health habits after preventive health habits at Time 1 was entered (R^2 change = .265, beta = .562, $p < .05$). In contrast, self-efficacy and health value kept their predictive power over diabetes-related habits even after diabetes-related habits at Time 1 was controlled. In the finalized model of diabetes-related habits, all demographic variables were not significant, while educational level, physical functioning at Time 2, and religious affiliation to Chinese God remained significant in the finalized model of preventive health habits. The R^2 values were high in the three models of preventive health habits (.507), diabetes-related model (.612) and health habit index (.631).

Insert Tables 15 & 16 about here

The model demonstrated that self-efficacy and health value were significant variables in predicting not only the health habits reported at Time 1 but also that at Time 2. They had direct positive effects on the health habits at Time 2, though the effect was only moderate as compared with health habits at Time 1. In conclusion, the habits practice at Time 1 was the best predictor of the habit practice at Time 2. The resultant regression model of general health habits and that of diabetes-related habits are more or less the same, except that health value was the significant predictor of diabetes-related habits but not general health habits at Time 2. Self-efficacy influenced general health habits practice and diabetes-related habits at Time 2. However, psychological variables did not show direct influence on preventive health habits practice at Time 2. On the other hand, several demographic variables such as educational attainment emerged as significant predictors of preventive health habits at Time 2.

Discussion

Predictors of Health Habits at Time 1

The Hong Kong Chinese elderly participants with diabetes generally reported acceptably good health status as well as a healthful lifestyle. The scores of our participants on general health and vitality were higher (i.e. outside the 95% CI of the age-matched norm mean) than the population norm of the Hong Kong elderly (Lam et al., 1999). The participants' scores in other domains were comparable to their aged peers in Hong Kong.

Moreover, the Chinese elderly participants generally adopted many good health habits. This result was similar to the finding based on Western elderly sample (Marks & Lutgendorf, 1999). Among our elderly participants with NIDDM, two underlying dimensions of health habits were identified – diabetes-related and preventive health habits. Health habit index represents the general health-related lifestyle adopted by the elderly patients. On the other hand, diabetes-related habits characterize those habits, which are important in controlling NIDDM. For example, regular blood glucose self-test and watching for possible body signs like foot problems are especially practical behaviors for NIDDM patients to keep track of their own diabetes condition and prevent complications. Most of these habits are explicitly recommended and even checked regularly by the health professionals to the patients

(Swanson, 1999). Preventive health habits are related to general illness/accident prevention and health knowledge improvement in nature. Their importance to health is less prominent, especially in the patient population, and much less mentioned in both clinic and public. Diabetes-related habits constitute a direct health influence, while preventive health habits are rather protective and the consequence "seems" like less hazardous when it is not followed. However, they can significantly reduce mortality and morbidity rate in the long run (Taylor, 1999).

Results supported the multi-dimensionality of health behaviors (Kannas, 1982; Langlie, 1977; Quinn & Johnson, 1997; Vickers et al., 1990; Walker et al., 1987). However, these two dimensions are different from what researchers identified among healthy adults. For instance, Langlie (1977) suggested that violation of a dimension of activities like exercise, nutrition and seat belt use would impose only "indirect risk" on an individual, while another type of behaviors like smoking and unsafe driving behaviors is more hazardous to health, that is, "direct risk". In contrast, among the elderly patients of the present study, diabetes-related habits like poor nutrition combat "direct risks" raised by the diabetes, while preventive health habits protect their health from illness in a rather indirect way. It is easily seen that the "risk" perception varies across populations and hence the components of a habit dimension or even number of dimensions may also diverge.

As hypothesized, physical functioning was positively correlated with healthful habits. After controlling the demographic effects, self-efficacy, health value, as well as HLC constructs significantly predicted general, diabetes-related, and preventive health habits and about 39%, 35%, and 17% of the variances were respectively accounted by these three variables together. On the other hand, results of the interaction terms, like HV*IHLC, SE*IHLC, and HV*SE*IHLC, failed to support the hypothesized moderator effects of health value as well as internal health locus of control on general, diabetes-related, or preventive health habits. In other words, Chinese elderly patients will engage in healthful habits if they believe that they can practise them, regardless of whether or not they possess internal health locus of control. Likewise, they also practice more good habits if they believe that their health is in their hands, regardless of whether or not they value their health. Similar finding were also noted in a Western study of Paxton and Sculthorpe (1999) on adults' attempt to lose weight. A possible reason of these findings is that, our participants generally valued health and acquired certain level of belief on self-control over their disease from the nurses' education. If all participants belong to "high health value" and "high internal control" group, moderator effects of internal health locus of control and health value will not be obtained, and self-efficacy and internal health locus of control will predict their habits independently. In the present study, the high mean scores of both health value and internal health locus of control provided support to this speculation.

Results showed that both health value and self-efficacy emerged as the most salient predictors of Chinese elderly participants' health habits, no matter these habits were general, diabetes-related or preventive. These findings supported the facilitative effect of self-efficacy, which has been well documented (for a review, see Schwarzer & Fuchs, 1996). It should be noted that the ability of self-efficacy to predict general health habits was greater than that to either diabetes-related habits or preventive health habits. This result can be explained in light of that the self-efficacy measurement instrument used in the current study was designed to assess the participants' perceived competence to perform general healthful habits but not specific dimensions of habits.

Similar to both local (Fung, 1998) and Western studies (e.g. Bennett et al., 1997; Kristiansen, 1985; Norman at al., 1998; Weiss & Larsen, 1990; Wurtele et al., 1985), healthful behaviors were found to increase with health value. However, some Western studies typically showed that health value only accounted for a small proportion of variance in health-related behaviors, whereas, the present study indicated that health value accounted for a large proportion of variance in healthful habits. Gillis (1993) suggested that the low or even non-significant predictive power of health value on health-related behaviors in previous Western research might be the result of its high skewness. In the present study, though health value skewed to high value, its skewness was acceptably low (Mean = 3.34; Skewness = -.551). These results demonstrated that, not withstanding Hong Kong Chinese generally valued their health, the increase in their health value leaded to an increase in their adoption of healthful habits.

The present results showed that an increase in both internal and doctor locus of control orientation also leaded to a higher level of health habits engagement. These findings provided support that the HLC beliefs were useful in predicting health behaviors of Chinese elderly patients. Even though there were researchers casting doubt on the necessity of continuing to use HLC constructs in predicting health behaviors (Calnan, 1989; Norman & Bennett, 1996), results of the present study suggested that the HLC constructs did contribute in explaining the variances in the adoption of health habits among Chinese elderly patients whose lives were usually simpler.

The HLC constructs had different predictive power on different types of habits. Belief in doctor's control over one's health was regarded as an essential belief influencing diabetes-related habits. In the preventive aspect, people with higher

IHLC scale score reported more preventive health habits. These findings support Kirscht's suggestion (1983) that health professional plays an important role especially in influencing the engagement of habits, which have clear health-related purpose and involve medical care system. In that instance, DM clinicians were more involved in diabetes-related habits practice than in preventive practice by giving explicit guidance and supervision to the patients. Thus, whether the participants practised these habits was significantly linked to whether they believed their doctor's competence and advice in altering their health condition. On the other hand, belief in one's own control over health is more influential in engagement of preventive health habits. Understanding the pattern of cognitive thinking and organization of the elderly patients, and aware the presence of differences in determinants among health habits dimensions provides more accurate information of what can be done to modify the target habits.

Nevertheless, inconsistent with previous qualitative studies (Hanson, 1984; Hoeman & Ku, 1996), results of the regression analyses did not support that chance health locus of control significantly predicted habits of Chinese elderly. However, results of correlation analysis showed that it was significantly correlated with preventive health habits in the inverse direction. That is, if an elderly individual possesses a lower level of chance control orientation, he/she is more likely to engage in preventive behaviors. The significant positive correlation between belief of others' control over health and preventive health habits was another interesting finding. These findings may be due to the fact that preventive health habits are less disease-focused and clinicians seldom formally educate the elderly patients about it. Hence, it seemed to be influenced by other external control beliefs. First, for those people who view health-related accident or deterioration of health as more fate-determined or by chance or "unavoidable", it seems reasonable to not taking any these preventive procedures. In addition, compared to clinicians, family members are more concerned about preventive health habits of the elderly. Hence individuals with health control orientation on significant others are more likely to take significant others' opinion and thus health-preventive action. The non-significant predictive values of chance and others health locus of control on preventive health habits were obtained possibly because they accounted the similar portion of variance of this type of habits that had been explained by other salient variables like self-efficacy, internal health locus of control, and physical functioning. It is recommended that when a health professional plans to promote less direct illness-related but preventive health habits, he/she has to consider more about other external health control orientation constructs beside DHLC. Ways to reduce the beliefs in chance/fate should also be further investigated.

On the other hand, there were four demographic, but none of medical, variables significantly associated with health habits practice at Time 1. They were current physical functioning, age, religious affiliation, and education attainment. Consistent with the previous study, patients' health status predicted their healthful lifestyle (Duffy, 1988; Duffy et al., 1996; Frank-Stromborg et al., 1990; Muhlenkamp et al., 1985; Wehrwein & Eddy, 1993), in general, diabetes-related, or preventive aspects. However, one should note that the predictive power of psychological factors such as self-efficacy overwhelmed that of physical health status, which lost abilities to predict various health habits of the Chinese elderly.

Present finding regarding to positive age effect on health-related behaviors was consistent with previous studies on patient populations (Frank-Stromborg et al., 1990; Wurtele et al., 1985). However, among our Chinese participants, the age effect was overwhelmed by other demographic and psychological variables and hence age did not enter the model of health habits. Furthermore, congruent with previous findings (Muhlenkamp et al., 1985), religious affiliation has certain discriminating power over whether one practices healthful habits. In the current study, Protestants/Catholics were found to perform more habits, no matter in general or specific dimensions. Their prohibitions over the use of harmful substances like tobacco/alcohol possibly resulted in this association. Nevertheless, religious affiliation to Protestant/Catholic was not significant in the final model of general, diabetes-related, and preventive health habits.

Physical functioning, age and religious affiliation were not significant predictors of health habits at Time 1 because health value and perceived control constructs had stronger predictive power and accounted for their explained variances of health habits. On the other hand, educational attainment was the salient demographic variable. Similar to previous findings (Frank-Stromborg et al., 1990; Muhlenkamp et al., 1985), higher level of educational attainment predicted more health habits, especially the preventive ones. However, inconsistent with some studies on patients and aged people (Muhlenkamp et al., 1985; Stoller & Pollow, 1994), gender effect on healthful habits was not found in the present study. Furthermore, gender was not a moderator of the main psychological factors on influencing gereral health habits.

In sum, as the coefficients of most of the demographic variables were no more statistically significant when other psychological variables were entered, the value of considering their effects on habits was lessened. Results also supported our hypothesis that these cognitive constructs were important in determining health behaviors of elderly patients if the specificity of their measurement instrument was considered in the research. Moreover, they can be used to develop general profiles for the NIDDM patients with active self-care and those with non-active self-care. Active patients generally have higher scores on IHLC and DHLC scales, which coincide with a higher level of health value and self-efficacy, while non-active patients have a lower level of self-efficacy, health value, internal health locus of control, as well as doctor health locus of control.

Predictive Power of Psychological Constructs over Habits at Time 2

Health habits were also shown to be stable constructs across time. These results supported the hypothesis that the measured health habits were settled practice and would not drastically change without well-design intervention or occurrence of life-change events. Similar to the present findings, other studies have also shown that aged people's health habits like drinking habits have also been found to be highly stable over long period of time (Walton, Mudd, Blow, Chermack, & Gomberg, 2000).

Results of regression analyses demonstrated the importance of psychosocial factors in predicting healthful habits across different time points. Though determinants differed across habit dimensions, the general tendency to engage in healthful habits was observed to be a joint function of self-efficacy and health value. Self-efficacy and health value significantly accounted for the variation in general health habits and diabetes-related habits at Time 2, even when habits index at Time 1 was controlled. In other words, the health value and self-efficacy of elderly patients somewhat determined whether or not they would engage in healthful habits in the future. Increases in health value and self-efficacy predicted more healthful habits practice after six months. This finding was consistent with another longitudinal study of healthy adults (Seeman & Seeman, 1983), which demonstrated that health value predicted both the present and future health habits. On the other hand, the levels of habits adopted at Time 1 and Time 2 were highly correlated, and the bulk of the variance of the health habits reported at Time 2 was mainly explained by the health habits at Time 1. Again, these results illustrated that the health habits were quite constant across time. Furthermore, the HLC constructs would affect health habits at Time 2 through influencing health habits at Time 1.

Physical functioning at Time 2 and religious affiliation to western religion or Chinese Gods were consistently appeared in the models of general, diabetes-related, as well as preventive health habits. However, in both constructs of general health habits and diabetes-related habits, most of these variables lost their predictive power when health habits at Time 1 and psychological variables were considered. In contrast, demographic variables, especially educational attainment, seemed to be more important predictor to preventive health habits at Time 2. Educational level was significant demographic predictor of preventive health habits at Time 2, regardless of whether or not the health habits at Time 1 and other psychological variables were added into the regression model. Similar to the results at the first wave, people with higher educational attainment reported more preventive health habits at Time 2. Also, Religious affiliation to Chinese Gods was significant demographic predictor to general and preventive health habits in the finalized regression models. Compared to those without religious affiliation, the participants who believed in Chinese Gods reported more healthful habits.

Glycemic Control

In the present study, results showed that metabolic control was not directly associated with general health habits practice. However, marginally significant association between HbAlc level and diabetes-related habits, but not preventive health habits, was found. The elderly participants with better glycemic control tended to report more diabetes-related habits. On the other hand, no significant difference of internal control orientation level was found between good and poor blood glucose control groups, but the good control group possessed significantly higher level of doctor's control belief than the poor control group. The importance of perceived doctor's or powerful others' control in metabolic control has also been demonstrated in the study of Stenstrom and colleagues (1998). These relationships found in the present study suggested that belief in doctor's control of health might drive a Chinese elderly patient to practice more diabetes-related habits and thus lead to better control in their blood glucose level. Further research should be carried out as the present study design failed to test this suggested causality among perceived control, health habits, and metabolic control.

Results of the present study support that some health habits are more strongly linked to blood glucose control than others among NIDDM elderly participants. Compared to general healthful habits, some habits like diet and self-blood glucose testing are more salient predictors to blood glucose control (Rost et al., 1990; Schmidt, Rost, McGill, & Santiago, 1994). There has been a study showing that only home blood glucose monitoring (Weerdt et al., 1990), but not frequency of exercise (Rost et al., 1990), was found to have a significant correlation with blood glucose control. Hence, detailed analysis on daily dietary and activity pattern should reflect the association between blood glucose control and these salient habits in a more accurate way than self-report habits practice does. However, as the primary aim of the current study was to test the applicability of modified social learning theory on general health habits but not on a specific adherence behavior or metabolic control, self-report habits practice seemed adequate.

The present results also partly supported the notion of Shillitoe (1988) that contextual factors like treatment effects, as well as subjective evaluation of control by doctors or patients, had a leading influence on patients' blood glucose control. Results of the current study demonstrated that the significant relationship between treatment type and metabolic control. Those, who failed to control blood glucose level well, were more likely to receive insulin injection or a combined treatment of medication and insulin. As a result, both medicine and self-care, diabetes-related behaviors are essential for the elderly patients to control their blood glucose level.

Demographic and Medical Influences on Health Status and Psychological Variables

Consistent with previous local finding (Lam et al., 1999), gender differences were observed in elderly participants' reported health status. Compared to female participants, males consistently reported better quality of life in physical status, vitality, general health, and mental health across time. In the health belief aspect, female participants put more value on health and believe in fate/chance effect on health to greater extent than males did. This finding may be related to the gender difference in educational attainment as formal education reduces one's control orientation of chance over health. Previous study on patients with IDDM showed consistent result that more educated respondents (i.e. having college or graduate degree) scored significantly lower on the Chance subscale than the less educated ones (Ferraro et al., 1987).

Age was another salient demographic variables. Compared to younger elders, older participants' tended to report worse physical functioning, more bodily pain, longer DM duration, more times of visits to DM clinic, as well as higher tendency to receive insulin treatment. Moreover, among the Chinese elderly participants, the deterioration in both physical functioning and mental health within the measurement period was observed. This finding highlighted that the elderly participants who suffered from diabetes mellitus and other illnesses perceived both their physical and psychological health as getting worse with time.

Age difference on locus of control orientation was also found in the present study. Older Chinese participants were found to possess a lower level of internal health control orientation. This finding challenged the hypothesis Lachman (1986) made in his review of aging and control orientation. He hypothesized that older people might become more aware of external sources of control, while still maintaining their own sense of internal control. Based on Rotter's social learning theory (1975), people learn to associate behavior with outcome and then form the belief in internal control over outcome. As a result, the decrease in internal of locus of control belief among the present sample was possibly resulted from direct experience of failing to exert control over their health (i.e. outcome), when their diseases progressed with age.

Limitations

One limitation of the present study was the highly homogeneous sample assessed. All participants were elderly patients with NIDDM recruited in only one large hospital. The participants were potentially "better" patients, compared to those who did not visit DM nurse regularly, as their illness condition and health-related behaviors were closely supervised by health professionals. To reduce this potential bias, participants should be recruited from multiple sources. Also, although their health-related quality of life demonstrated that they were representative sample of general elderly population in Hong Kong, the degree of generalizability of some diabetes-specific findings such as two underlying dimensions of health habits to general elderly population was in doubt. Moreover, the applicability of the findings in elderly population with other chronic illnesses like coronary heart diseases is unknown, though all measurement instruments used in the present study should be applicable to different elderly patient groups. For example, all habits described in the health habits checklist are good to the health of all the elderly, while MHLC-form C can also be modified according to the target population.

Regarding to the assessment tools, a limitation of this study is its self-report in nature. Kirscht (1983) has raised questions on the validity of self-report measures, which are subject to error due to faulty recall as well as intentional distortion. Keeping a diary is a good alternative but its application may be too complicated to the elderly. Furthermore, there was a lack of external verification of health habits. Significant others' testimonies can be obtained to corroborate the self-report of the elderly. In the present study, though biological indicators have been measured, they did not perfectly reflect whether health habits worked or even occurred, as the relationships were rather complicated and many biopsychosocial variables were involved (Shillitoe, 1988).

Another limitation of this study was that the items of the inventories of both health habits and psychological constructs were imported from Western studies. Although the face validity of the translated Chinese versions have been checked through feedbacks from psychologists as well as local Chinese elderly patients during the pilot study, their construct validities did not formally tested before administered. The relatively small overall amount of variance explained by the two dimensions of health habits implied the need to modify the health habits checklist by adding or deleting items. Furthermore, the present study did not test the stabilities of the psychological variables like self-efficacy due to the interview time limited by telephone follow-up. These constructs were assumed to be stable across time. Although previous findings have demonstrated that these beliefs were rather stable

(Halfens, 1995), some studies suggested that external health locus of control changed with utilization of both hospital and outpatient services among elderly community-dwellers (Bazargan, Bazargan, & Baker, 1998; Goldsteen & Counte, 1994). As a result, although high internal consistencies of the scales and expected inter-relationships were generally obtained in the present studies, future studies should be made on the validity, including the stability, of the Chinese version of these scales.

Besides, even though the present study results suggested that the HLC constructs had good predictive power over health habits among the vulnerable patient groups, this study failed to make direct comparison between healthy group and patient group to verify the hypothesis that HLC constructs would have more predictive among vulnerable groups.

Research and Practical Implications

Healthful habits are important to every individual and the present study examined a high-risk group for poor health. The present findings suggested that both the research and intervention of health-related lifestyle should be more target- and domain-specific in order to give a clear picture of what are the most prominent factors in predicting and intervening the habits of different populations. Moreover, results demonstrated the significant positive correlation between healthful habits and physical functioning among Chinese elderly patients. It was also suggested that metabolic control was only related to specific self-care behaviors but not general healthful habits.

The present study also tested the psychometric properties of a health habits scale and identified two distinct underlying dimensions of health habits among Chinese elderly participants with NIDDM. The general health habits index was found to have high internal consistency as well as short-term stability and provided a better alternative of assessment instrument in health behavior research. Moreover, results of present study indicated the significance of considering different dimensions of health habits when studying their relationships with health status, metabolic control, and psychological variables.

The success of the present study in using social learning constructs to explain healthful habits highlighted the importance of considering the specificity of the measurement instruments to both the target habits and population. Furthermore, elderly population is influenced less by external events like busy work, which have been reported to result in less than perfect achievement of adherence of management regimen as well as metabolic control (Coates & Boore, 1995). Elders with NIDDM perceived fewer barriers and stress to adherence than did younger adults (Glasgow et al., 1989). This was another possible reason why the social learning constructs predicted the healthful habits practice so well in the present study. Since people in different categories experience distinct motivations and encounter different obstacles in pursuing the healthful habits, it is not surprising that attempts to develop a single model of behaviors have met with limited success.

Results of the present study also shed light on how to improve the lifestyle of Chinese elderly with chronic illnesses. Health habits were quite stable across time, even though the participants keep visiting the DM nurses and receiving education to certain extent. Bunting and Coates (2000) also reported that regular attendance at hospital outpatient clinics appeared to have little impact on the reduction of blood glucose level. However, in the present study, it was also possible that the nurses' education focused on modification in dietary, exercises, and medical regimen adherence to improve patients' blood glucose control, but not general healthful habits. Therefore, compared to general health-related lifestyle change, serial changes of patients' glycosylated hemoglobin levels would be better indicator of the effectiveness of this formal medical supervision and education. Results of general health habits in the present study should not be used to evaluate the effectiveness of clinic education. More important, the present study highlighted the significance of perceived control in influencing those health habits which have functions more than controlling blood glucose level. Hence, effectiveness of other types of interventions, besides formal medical supervision and education, should be investigated in order to improve the entire health-related lifestyle of the elderly. Since health value is rather difficult to alter, modification in control beliefs like self-efficacy should be an effective way.

The present study showed that self-efficacy predicted the current healthful habits practice and its further improvement. Those who were more self-efficacious not only engage in more health habits during the initial measurement time period but also reported more health habits half-year later. Pervious studies have shown that adequate diabetes education can also enhance patients' self-efficacy in the management of diabetes (Rubin, Peyrot, & Saudek, 1989). Functional Insulin Treatment (FIT), which allows patients to selectively use insulin for eating fasting, or correcting hyperglycaemia, was found to empower the self-efficacy of adult patients with IDDM, with high treatment satisfaction and significant improvement of glycemic control in the long run (Howorka, Pumprla, Wagner-Nosiska, Grillmayr, Schlusche, & Schabmann, 2000). However, its applicability in elderly NIDDM patients with insulin treatment, who was found to have poor glycemic control in the present study, remains doubtful. Moreover, these interventions aim at enhancing perceived competence of diabetes-control but not self-efficacy toward general healthful habits. New components about prevention should be added into these intervention programs. Other potential intervention processes, such as "resource communication" suggested by Schwarzer and Renner (2000), are also possible ways to improve perceived self-efficacy. Resource communication is expected to be particularly effective for health promotion, in which people are made aware not only the risks, but also their coping resources to the risks (e.g. accidents and illnesses).

The HLC beliefs also, with less contribution than self-efficacy belief, influence health habits practice of the Chinese elderly patients. However, as different HLC constructs are involved in engagement of different types of health habits, the goal of intervention has to be clearly identified beforehand. For instances, results showed that internal health locus of control exerted effects on both general and preventive health habits, while belief in doctor's control significantly predicted general and diabetes-related habits. Belief in chance/fate was also negatively associated with preventive health habits. Besides, the "side-effect" of promoting certain construct of health locus of control should be considered. The HLC constructs have been shown to significantly influence the utilization of emergency room and other medical services by the non-institutionalized elderly (Bazargan et al., 1998). The implementation of any program which promotes PHLC or DHLC beliefs should be cautious as an increase in both healthful behaviors and medical services utilization may be resulted. In general, it is most recommended to promote the belief in own control over health in intervention program. Previous findings give sufficient support to the positive impact of internal health locus of control on different health-related issues. For example, elderly people with a higher level of internal health locus of control have been illustrated to exhibit more self-care habits, better psychological health (Wu, Tang, & Kwok, 2000), and less careless utilization of hospital services (Bazargan et al., 1998).

Though the feasibility of changing health locus of control is being questioned, it is generally believed to be more subject to change than the general locus of control (Wallston et al., 1994). Wallston (1989) also asserts that health locus of control is a belief that subject to change with direct and vicarious experience on health. Further study should be done to evaluate the effectiveness of education program to change the health locus of control among elderly patients with NIDDM and other chronic illnesses. For instance, a study has showed that children's internality of HLC improved gradually following their participation in an exercise program (Labbe & Welsh, 1993). Moreover, greater health-related cognitive distortion such as overgeneralization of past health-related experience over different conditions and irrational inferences (e.g. "A medication that makes me feel tired can't be good for me") is also associated negatively with internal health locus of control and positively chance health locus of control (Christensen, Moran, & Weibe, 1999). Christensen and colleagues suggested that intervention programs should be directed toward the identification and modification of maladaptive, distorted thinking, adjunct to more traditional health-education approaches that rely solely on the provision of information. Other learning channels suggested by social cognitive theory (Bandura, 1997) like observational learning provide possible alternative way to change these beliefs. Further research is needed to test the usefulness of different types of intervention in facilitating positive health practices in the elderly patient population.

It is essential to consider the self-efficacy and HLC beliefs of the patient when educating self-care habits and planning the treatment. Firstly, they act as individual characteristics of the patients and the HLC and SE and HV instrument may be useful in determining which patients may need additional encouragement and support in adopting a new self-care regimen. Secondly, analysis of patients' health beliefs provides information on what type of intervention is appropriate to them. One's expectancies about control over health are related to their preferences for control over his/her health care. For example, those with a low level of belief/expectancy of own control over health tend to show low desire/concern to involve in health care (Wallston, Smith, King, Forsberg, Wallston, & Nagy, 1983). Similar to this finding, diabetes educators also suggest that DM patients with distinct control orientation should be treated differently because better health outcomes, greater satisfaction, and better adherence to a medical regimen result, if treatment is congruent with a patient's specific control beliefs (Edelstein & Linn, 1987). For instance, externally controlled patients tended to rely more on the health opinions provided by their important others. These patients appear to be more positively influenced by explicit guidelines of active self-care and seldom adjust these guidelines to daily fluctuations (Strickland, 1978). Therefore, strong guidance and supervision with very structured education should be given to these patients. On the other hand, for internally controlled patients, democratic cooperation between health professionals and patients was recommended since they usually participate into the treatment actively and prefer situations in which they can assume responsibility and work independently (Strickland, 1978).

The present study opened some future research directions. First, the health locus of control constructs among Chinese population should be further studied. In the present study, though the health locus of control constructs added additional predictive value to the model of health habits, their value was much less than that of self-efficacy, which was found to be the most prominent factors of current and future health habits practice. In the previous research of health-related outcomes among Chinese samples, the predictive values of the health locus of control constructs were equivocal. For example, Wu and colleagues (2000) found that internal health locus of control did not predict psychological adjustment among Chinese elderly with chronic illnesses, whereas Ma (1997) reported that, among patients with nasopharynx carcinoma, the internals showed better short-term adjustment than the externals did. The modest and inconclusive quantitative findings of the relationships between health locus of control constructs and health-related issues among Chinese underlined a basic question that whether the health locus of control concept can be applied to Chinese populations. However, qualitative studies (Hanson, 1984; Hoeman & Ku, 1996) suggested that fatalistic view, which was believed to contribute to external control orientation, influenced the implement of healthful habits practice among Chinese. The problem may lie on differences in components of health locus of control across different cultures and this lowers the predictive value of this concept over health habits or related issues. For example, during the interviews, many elderly participants mentioned that they expected their medical condition would deteriorate because "it was a natural phenomenon", though they did not think their medical condition was a matter of "fate or chance" as described in the questionnaire. However, this "natural phenomenon expectancy" was not included in the Western concept of health locus of control. This example helps to illustrate the possible discrepancy between Chinese and Western control beliefs over health. Therefore, it is recommended to validate and improve the constructs of this concept and assessment items by conducting more basic qualitative and quantitative research in Chinese populations to understand their concept of health locus of control.

Secondly, the relationships among different aspects of illness-control, specific health behaviors, psychological constructs, and contextual variables like treatment types should be further studied in a more precise way. Results of the present study only suggested a possible causality that diabetes-related habits, determined by cognitive variables, influenced the metabolic control. However, such causality cannot be confirmed by the current study design. Long-term longitudinal research should be conducted to clear the picture and change in metabolic control should be measured. Such study design also helps to understand long-term influences of illness, health habits or even interventions. Furthermore, the underlying reasons for some significant demographic effects on health habits practice should be investigated. For instance, the present study found that Chinese Gods believers reported more healthful habits at Time 2 than participants without religious affiliation did. However, we failed to confirm whether their improvement was the consequence of change in perceived control or not. However, one of the most practical and significant future research focuses is the evaluation of the effectiveness current and future design of interventions in enhancing the perceived control, healthful habits, as well as health status of the elderly with chronic illnesses.

Conclusion

Social cognitive variables like self-efficacy consistently improved the prediction of healthful habits of the Chinese elderly patients with NIDDM beyond that attributable to demographic factors like gender and income. With refinement in theory and measurement instruments, it was illustrated that the salient social-cognitive variables of social learning theory – self-efficacy, health value, and the HLC constructs – individually exerted a robust impact on the practice of health habits. These factors accounted for a large amount of the variances of current and future healthful habits. Though the modified social learning theory was not supported by the present results, the significance to consider the control beliefs in intervention was demonstrated. Further study should focus on how to effectively intervene the control beliefs of the patients. Long-term influences of the intervention on beliefs, health habits, and metabolic control should also be more carefully examined.

References

Affleck, G., Tennen, H., Pfeiffer, C., & Fifield, J. (1987). Appraisals of control and predictability in adapting to a chronic disease. Journal of Personality and Social Psychology, 53, 273-279.

Ajzen, I., & Fishbein, M. (1980). Understanding Attitude and Predicting Social Behavior. Englewood Cliffs, NJ: Prentice-Hall.

Anderson, E. S., Winett, R. A., Wojcik, J. R. (2000). Social-cognitive determinants of nutrition behavior among supermarket food shoppers: A structural equation analysis. Health Psychology, 19(5), 479-486.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman.

Bandura, A. (1984). Recycling misconceptions of perceived self-efficacy. Cognitive Therapy and Research, 8(3), 231-255.

Bazargan, M., Bazargan, S., & Baker, R. S. (1998). Emergency department utilization, hospital admission, and physical visits among elderly African American persons. Gerontologist, 38(1), 25-36.

Bennett, P., Moore, L., Smith, A., Murphy, S., & Smith, C. (1995). Health locus of control and value for health as predictors of dietary behavior, Psychology and Health, 10(1), 41-54.

Bennett, P., Norman, P., Moore, L., Murphy, S., & Smith, C. (1997). Health locus of control and value for health in smokers and non-smokers. Health Psychology, 16(2), 179-182.

Bradley, C., Lewis, K. S., Jennings, A. M., & Ward, J. D. (1990). Scales to measure perceived control developed specifically for people with tablet-treated diabetes. Diabetic Medicine, 7(8), 685-694.

Breslow L., & Enstrom, J. E. (1980). Persistence of health habits and their relationship to mortality. Preventive Medicine, 1, 409-421.

Bunting, B. P., & Coates, V. (2000). Stability and predictors of blood glucose levels: an intra- and inter-individual analysis. Psychology, Health, & Medicine, 50(3), 251-258.

Calnan, M. (1989). Control over health and patterns of health-related behavior. Social Science and Medicine, 29(2), 131-136.

Census and Statistics Department (1999). Hong Kong Annual Digest of Statistics 1999 Edition. Hong Kong: Census and Statistics Department, Hong Kong Government Printing Office.

Chi, I. & Lee, J. J. (1989). A Health Survey of the Elderly in Hong Kong. Hong Kong: University of Hong Kong.

Chi, I, & Lee, J. (1991). Health Education for the elderly in Hong Kong. Educational Gerontology, 17, 507-518.

Christensen, A. J., Moran, P. J., & Weibe, J. S. (1999). Assessment of irrational health beliefs: Relation to Health Practices and Medical Regimen Adherence. Health Psychology, 18(2), 169-176.

Chrisensen, A. J., Wiebe, J. S., Benotsch, E. G., & Lawton, W. J. (1996). Perceived health competence, health locus of control, and patient adherence in renal dialysis. Cognitive Therapy and Research, 20(4), 411-421.

Coates, V. E., & Boore, J. R. P. (1995). Self-management of chronic illness: implications for nursing. International Journal of Nursing Studies, 32(6), 628-640.

Conner, M., & Norman, P. (1996). Predicting Health Behavior. Research and Practice with Social Cognition Models. Burkingham: Open University Press.

Coppard, L. C. (1985). Self-health/care and the elderly. In Toward the Well-being of the Elderly. Washington, D.C.: Pan American Health Organization.

Cox, D. J., & Gonder-Frederick, L. (1992). Major developments in behavioral diabetes research. Journal of Consulting and Clinical Psychology, 60, 628-638.

Cox, D. J., Gonder-Frederick, L., Pohl, S., & Pennebaker, J. W. (1986). Diabetes. In Holroyd, K. A. & Creer, T. L. (Eds), Self-management of Chronic Disease. Orlando: Academic Press.

Duffy, M. (1988). Determinants of health promotion in midlife women. Nursing Research, 37(6), 358-362.

Duffy, M. E., Rossow, R., & Hernandez, M. (1996). Correlates of health-promotion activites in employed Mexican American women. Nursing Research, 45(1), 18-24.

Edelstein, J. & Linn, M. W. (1987). Locus of control and the control of diabetes. Diabetes Educator, 13, 51-54.

Ferraro, L. A., Price, J. H., Desmond, S. M., Roberts, S. M. (1987). Development of a diabetes locus of control scale. Psychological Reports, 61, 763-770.

Frank-Stromborg, M., Pender, N. J., Walker, S. N., & Sechrist, K. R. (1990). Determinants of health-promoting lifestyle in ambulatory cancer patients. Social Science and Medicine, 31(10), 1159-1168.

Fries, J. F., & Carpo, L. M. (1986). The elimination of premature disease. In K. Dychtwald & J. MacLean, Wellness & Health Promotion for the Elderly. Rockville: Aspen.

Fuchs, R., Leppin, A., Schwarzer, R., & Wegner, M. (1993). Self-efficacy towards healthy eating behavior. In R. Schwarzer (Ed.), Measurement of Perceived

Self-efficacy: Psychometric Scales for Cross-cultural Research. Berlin: Der Prasident der Freien Universitat.

Fulder, S. (1983). An End to Ageing: Traditional and Modern Ways of Extending Healthy Life. Wellingborough: Thorsons.

Fung, S. Y. (1998). Fortors associated with breast self-examination behavior among Chinese women in Hong Kong. Patient Education and Counseling, 33, 233-243.

Gillis, A. (1993). Determinants of a health promoting lifestyle: An integrative review. Journal of Advanced Nursing, 18, 345-353.

Glasgow, R. E., Toobert, D. J., Riddle, M., Donnelly, J., Michell, D. L., & Calder, D. (1989). Diabetes-specific social learning variables and self-care behaviors among persons with type II diabetes. Health Psychology, 8(3), 285-303.

Goldsteen, R. L., & Counte, M.A. (1994). Examining the relationship between health locus of control and the use of medical care services. Journal of Aging and Health, 6(3), 314-335.

Halfens, R. J. G. (1995). Effect of hospital stay on health locus of control beliefs. Western Journal of Nursing Research, 17(2), 156-167.

Hamman, R. F. (1992). Genetic and environmental determinants of noninsulin-dependent diabetes mellitus (NIDDM). Diabetes/Metabolism Review, 8, 287-338.

Hanson, K. J. (1984). Development and preventive health behaviors: The case of Taibei, Taiwan. Michigan: University Microfilms International.

Harris, R., Linn, M. W., & Pollack, L. (1984). Relationship between health beliefs and psychological variables in diabetic patients. British Journal of Medical Psychology, 57, 253-259.

Helgeson, V. S. (1992). Moderatos of the relations between perceived control and adjustment to chronic illness. Journal of Personality and Social Psychology, 63(4), 650-666.

Helman, C. G. (1990). Culture in Health and Illness (2nd Ed.). London: Wright.

Hoeman, S. P., & Ku, Y. L. (1996). Health beliefs and early detection among Chinese women. Western Journal of Nursing Research, 18(5), 518-533.

Hong Kong Department of Health (1997/98). Annual Report of Department of Health. Hong Kong: Hong Kong Department of Health.

Hong Kong Hospital Authority (1997/98). Hospital Authority Statistical Report. Hong Kong: Hospital Authority.

Howorka, K., Pumprla, J., Wagner-Nosiska, D., Grillmayr, H., Schlusche, C., & Schabmann, A. (2000). Empowering diabetes out-patients with structured education: Short-term and long-term effects of functional insulin treatment on perceived control over diabetes. Journal of Psychosomatic Research, 48, 37-44.

Janz N. K., & Becker, M. H. (1984). The health belief model: A decade later. Health Education Quarterly, 11, 1-47.

Johnson, S. B. (1992). Methodological issues in diabetes research. Measuring adherence. Diabetes Care, 15(11), 1658-1667.

Kannas, L. (1982). The dimensions of health behavior among young men in Finland. International Journal of Health Education, 24, 146-225.

Kaplan, R. M., Atkins, C. J., & Reinsch, S. (1984). Specific efficacy expectations mediate exercise compliance in patients with COPD. Health Psychology, 3, 223-242.

Kart, C. S. (1985). The Realities of Aging: An Introduction to Gerontology (2nd Ed.). Boston: Allyn and Bacon.

Kerson, T. S., & Kerson, L. A. (1985). Understanding Chronic Illness. New York: Free Press.

Kirscht, J. P. (1983). Preventive health behavior: A review of research and issues. Health Psychology, 2, 277-301.

Kohlmann, C., Schuler, M., Petrak, F., Kustner, E., Krohne, H. W., & Beyer, J. (1993). Associations between type of treatment and illness-specific locus of control in type 1 diabetes patients. Psychology and Health, 8, 383-391.

Kristiansen, C. M. (1985). Value correlates of preventive health behavior. Journal of Personality and Social Psychology, 49(3), 748-758.

Kronenfeld, J. J., Goodyear, N., Pate, R., Blair, A., Howe, H., Parker, G., & Blair, S. N. (1988). The interrelationship among preventive health habits. Health Education Research, 3(3), 317-323.

Kung , A. W. & Janus, E. D. (1997). The prevalence of diabetes mellitus in elderly subjects in Hong Kong. In S. Lam (Ed), The Health of the Elderly in Hong Kong. Hong Kong: Hong Kong University Press.

Labbe, E. E. & Welsh, C. (1993). Children and running: Changes in physical fitness, self-efficacy, and health locus of control. Journal of Sport Behavior, 16(2), 85-97.

Lachman, M. E. (1986). Locus of control in aging research: A case for multidimentional and domain-specific assessment. Journal of Psychology and Aging, 1(1), 34-40.

Lam, C. L. K., Lauder, I. J., Lam, T. P., & Gandek, B. (1999). Population based norming of the Chinese (HK) version of the SF-36 health survey. The Hong Kong Practitioner, 21, 460-469.

Lam C. L. K., Gandek, B., Ren, X. S., & Chan, M. S. (1998). Tests of scaling assumptions and construct validity of the Chinese (HK) version of SF-36 Health Survey. Journal of Clinical Epidemology, 51, 1139-1147.

Langile, J. K. (1977). Social networks, health beliefs, and preventive health behavior. Journal of Health and Social Behavior, 18, 244-260.

Lau, R. R., Hartman, K. A., & Ware, J. E., Jr. (1986). Health as a value: Methodological and theoretical considerations. Health Psychology, 5(1), 25-43.

Lau, R. R., & Ware, J. E., Jr. (1981). Refinements in the measurement of health-specific locus of control beliefs. Medical Care, 19,1147-1158.

Leung, E. M., & Lo, M. B. (1997). Social and health status of elderly people in Hong Kong. In S. Lam (Ed), The Health of the Elderly in Hong Kong. Hong Kong: Hong Kong University Press.

Ma, J. L. C. (1997). Factors influencing adjustment of patients suffering from nasopharynx carcinoma – implications for oncology social work. Social Work in Health Care, 25(4), 83-103.

Mak, W. F. (1999). Psychosocial correlates of drug adherence among patients with affective disorder in Hong Kong. Master Thesis Submitted to the Graduate School of the Chinese University of Hong Kong.

Marks, G. R., & Lutgendorf, S. K. (1999). Perceived health competence and personality factors differentially predict health behaviors in older adults. Journal of Aging and Health, 11(2), 221-239.

Mazzuca, K. B., Farris, N. A., Mendenhall, J., & Stoupa, R. A. (1997). Demonstrating the added value of community health nursing for clients with insulin-dependent diabetes. Journal of Community Health Nursing, 14(4), 211-224.

Muhlenkamp, A., Brown, N., & Sands, D. (1985). Determinants of health promotion activities in nursing clinic clients. Nursing research, 34(6), 327-332.

Myers, L. B. & Myers, F. (1999). The relationship between control beliefs and self-reported adherence in adults with cystic fibrosis. Psychology, Health & Medicine, 4(4), 387-391.

Norman, P. (1991). Social learning theory and the prediction of attendance at screening. Psychology and Health, 5, 231-239.

Norman, P. (1995). Health locus of control and health behavior: An investigation into the role of health value and behavior-specific efficacy beliefs. Personality and Individual Differences, 18, 213-218.

Norman, P., & Bennett, P. (1996). Health locus of control. In M. Conner & P. Norman (Eds), Predicting health behavior. Buckingham: Open University Press.

Norman, P., Bennett, P., Smith, C. & Murphy, S. (1998). Health locus of control and health behavior. Journal of Health Psychology, 3(2), 171-180.

Padula, C. (1997). Older couples' decision making on health issues. Western Journal of Nursing Research,18(6), 675-687.

Pan American Health Organization (1985). Toward the Well-being of the Elderly. Washington, D. C.: Pan American Health Organization.

Paxton, S. J., & Sculthorpe, A. (1999). Weight and health locus of control beliefs in an Australian community sample. Psychology and Health, 14, 417-431.

Pender, N. J. (1987). Health Promotion in Nursing Practice (2nd Ed.). Norwalk, CT: Appleton Century Crofts.

Peyrot, M., & McMurry, J. F. (1985). Psychosocial factors in diabetes control: Adjustment of insulin-treated adults. Psychosomatic Medicine, 47(6), 542-557.

Quinn, M. E., & Johnson, M. A. (1997). Factors of nutritional health-seeking behaviors. Journal of Aging and Health, 9(1), 90-115.

Rosenstock, I. M. (1974). Historical origins of the health belief model. Health Education Monographs, 2, 328-335.

Rost, K. M., Flavin, K. S., Schmidt, L. E., & McGill, J. B. (1990). Self-care predictors of metabolic control in NIDDM patients. Diabetes Care, 13(11), 1111-1113.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs: General and Applied, 80(1), 1-28.

Rotter, J. B. (1975). Some problems and misconceptions related to the construct of internal versus external control of reinforcement. Journal of Consulting and Clinical Psychology, 43(1), 56-67.

Rubin, R. R., Peyrot, M., Saudek, C. D. (1989). Effect of diabetes education on self-care, metabolic control and emotional well-being. Diabetes Care, 12, 673-679.

Schmidt, L. E., Rost, K. M., McGill, J. B., & Santiago, J. V. (1994). The relationship between eating patterns and metabolic control in patients with non-insulin-dependent diabetes mellitus (NIDDM). Diabetes Educator, 20(4), 317-321.

Schwarzer, R., & Fuchs, R. (1996). Self-efficacy and health behaviors. In M. Conner & P. Norman (Eds), Predicting health behavior. Buckingham: Open University Press.

Schwarzer, R., & Renner, B. (2000). Social-cognitive of health behavior: Action self-efficacy and coping self-efficacy. Health Psychology, 19(5), 487-495

Seeman, M., & Seeman, T. E. (1983). Health behavior and personal autonomy: A longitudinal study of the sense of control in illness. Journal of Health and Social Behavior, 24, 144-160.

Shaprio, D. H., Schwartz, C. E., & Astin, J. A. (1996). Controlling ourselves, controlling our world. American Psychologist, 51(12), 1213-1230.

Shillitoe, R. W. (1988). Psychology and Diabetes: Psychological Factors in Management Control. London: Chapman & Hall.

Smith, M. S., Wallston, K. A., & Smith, C. A. (1995). The development and validation of the Perceived Health Competence Scale. Health Education Research, 10(1), 51-64.

Speake, D. L., Cowart, M. E., & Pellet, K. (1989). Health perceptions and lifestyles of the elderly. Research in Nursing and Health, 12, 93-100.

Stenstrom, U., Wikby, A., Andersson, P. & Ryden, O. (1998). Relationship between locus of control beliefs and metabolic control in insulin-dependent diabetes mellitus. British Journal of Health Psychology, 3, 15-25.

Steptoe, A., & Appels, A. (1989). Stress, Personal Control and Health. Chichester: Wiley.

Stewart, S. M., Lee, P. W. H., Low, L. C. K., Cheung, A., Yeung, W., Huen, K., & O'Donnell, D. (2000). Pathways from emotional adjustment to glycemic control in youths with diabetes in Hong Kong. Journal of Pediatric Psychology, 25(6), 393-402.

Stoller, E. P., & Pollow, R. (1994). Factors affecting the frequency of health enhancing behaviors by the elderly. Public Health Reports, 109(3), 377-189.

Strickland, B. R. (1978). Internal-external expectancies and health-related behaviors. Journal of Consulting and Clinical Psychology, 45, 647-653.

Swanson, J. (1999). Physical and Mental Issues in Aging Sourcebook. Detroit: Omnigraphics.

Taylor, S. E. (1999). Health Psychology. New York: McGrawhill.

Taylor, S. E., & Aspinwall, L. G. (1991). Psychosocial aspects of chronic illness.

In P. T. Costa & G. R. VandenBos (Eds.), Psychological Aspects of Serious Illness: Chronic Conditions, Fatal Diseases, and Clinical Care. Washington: American Psychological Association.

Thompson, Jr., R. J., Gustafson, K. E., Gil, K. M., Godfrey, J., & Bennett-Murphy, L. M. (1998). Illness specific patterns of psychological adjustment and cognitive adaptational processes in children with cystic fibrosis and sickle cell disease. Journal of Clinical Psychology, 54(1), 121-128.

Vickers, R., Conway, T., & Hervig, N. (1990). Development of replicable dimensions of health behavior. Preventive Medicine, 19, 377-401.

Walford, R. L. (1983). Maximum Life-span. New York: Norton.

Walker, S. N., Sechrist, K. R., & Pender, N. J. (1987). The Health-Promoting Lifestyle Profile: development and psychometric characteristics. Nursing Research, 36(2), 76-81.

Wallston, K. A. (1989). Assessment of control in health-care settings. In A. Steptoe, & A. Appels (Eds.), Stress, Personal Control and Health. Chichester: Wiley.

Wallston, K. A. (1991). The importance of placing measures of health locus of control in a theoretical context. Health Education Research, Theory and Practice, 6, 251-252.

Wallston, K. A. (1992). Hocus-pocus, the focus isn't strictly on locus: Rotter's social learning theory modified for health. Cognitive Therapy and Research, 16, 183-199.

Wallston, K. A., Stein, M. J., & Smith, C. A. (1994). Form C of the MHLC Scale: a condition-specific measure of locus of control. Journal of Personality Assessment, 63(3), 534-553.

Wallston, K. A., Smith, R. A., King, J. E., Forsberg, P. R., Wallston, B. S., & Nagy, V. T. (1983). Expectancies about control over health: relationship to desire for control of health care. Personality and Social Psychology Bulletin, 1, 377-385.

Wallston, K. A., Wallston, B. S., & DeVellis, R. F. (1978). Development of the multidimensional health locus of control (MHLC) scale. Health Education Monographs, 6, 160-170.

Wallston, B. S., Wallston, K. A., Kaplan, G. D., & Maides, S. A. (1976). The development and validation of the health related locus of control (HLC) scale. Journal of Counselling and Clinical Psychology, 44, 580-585.

Walton, M. A. , Mudd, S. A., Blow, F. C., Chermack, S. T., & Gomberg, E. S. L. (2000). Stability in the drinking habits of older problem-drinkers recruited from nontreatment settings. Journal of Substance Abuse Treatment, 18(2), 169-177.

Wardle, J., Steptoe, A., Bellisle, F., Davou B., Reschke, K., Lappalainen, R., & Fredrikson, M. (1997). Health practices among European students. Health Psychology, 16(5), 443-450.

Weerdt, I., Visser, A., Kok, G., & Veen, E. (1990). Determinants of active self-care behavior of insulin treated patients with diabetes: Implications for diabetes education. Social Science and Medicine, 30(5), 605-615.

Wehrwein, T. C., & Eddy, M. E. (1993). Breast health promotion. Journal of Holistic Nursing, 11, 223-236.

Weiss, G., & Larsen, D. L. (1990). Health value, health locus of control, and the prediction of health protective behaviors. Social Behavior and Personality, 18, 121-136.

Willis, L., Goodwin, J., Lee, K., Mosqueda, L., Garry, P., Liu, P., Linn, R., & Wayne, S. (1997). Impact of psychosocial factors on health outcomes in the elderly: A prospective study. Journal of Aging and Health, 9(3), 396-414.

Woo, J., Ho, S. C., Chan, S. G., Yu, A. L. M., Yuen, Y. K., & Lau, J. (1997). An estimate of chronic disease burden and some economic consequences among the elderly in Hong Kong population. Journal of Epidemiology and Community Health, 51, 486-489.

World Health Organization (WHO) (1994). Prevention of Diabetes Mellitus: Report of a WHO Study Group. Geneva: WHO.

Wrightson, K. J., & Wardle, J. (1997). Cultural variation in health locus of control. Ethnicity and Health, 2, 13-20.

Wurtele, S. K., Britcher, J. C., & Saslawsky, D. A., (1985). Relationships between locus of control, health value and preventive health behaviors among women. Journal of Research in Personality, 19, 271-278.

Wu, A. M. S., Tang, C. S., Kwok, T. C. Y. (2000). Self-efficacy, health locus of control, and psychological adjustment in elderly Chinese with chronic illnesses. Journal of Psychosomatic Research (in submission).

Ziff, M. A., & Conrad, P. (1995). The relative effects of perceived personal control and responsibility on health and health-related behaviors in young and mid-aged adults. Health Education Quarterly, 22(1), 127-142.

Footnotes

[1]The DM nurses at outpatient diabetes and endocrine center of the Prince of Wales Hospital provides an educational service to the outpatients with DM. Their patients join a group educational class of self-care at the center in their first 2 visits. Then, they usually have to visit the center regularly (about 3-4 months once commonly) and received education and supervision from the nurses individually. For those with poor metabolic control observed, the nurse will suggest them to visit the center more frequently. During the visit, the nurses keep track on the patients' metabolic control through their self-records of blood glucose monitoring and self-report of dairy activities. They provide professional advice on patients' medication as well as activities. This educational program may induce some influences on the health-related attitudes and beliefs of the patients.

Table 1 Demographic Information of the Participants

Demographic Variable	Total (N = 191)	Male (N = 117)	Female (N = 74)	Gender difference across categories
		N (%)		
Age				$\chi^2 (5) = 6.99$
60-64 years	50 (26.2)	29 (24.8)	21 (28.4)	
65-69 years	54 (28.3)	35 (29.9)	19 (25.7)	
70-74 years	44 (23.0)	24 (20.5)	20 (27.0)	
75-79 years	30 (15.7)	22 (18.8)	8 (10.8)	
80-84 years	10 (5.2)	4 (3.4)	6 (8.1)	
85-88 years	3 (1.6)	3 (2.6)	0 (0)	
Marital status				$\chi^2 (3) = 15.48$*
Never married	4 (2.1)	4 (3.4)	0 (0)	
Married	155 (81.2)	101 (86.3)	54 (73.0)	
Divorced	7 (3.7)	5 (4.3)	2 (2.7)	
Widowed/Separated	25 (13.1)	7 (6.0)	18 (24.3)	
Educational level				$\chi^2 (3) = 30.54$**
None or kindergarten	56 (29.3)	18 (15.4)	38 (51.4)	
Primary education	85 (44.5)	60 (51.3)	25 (33.8)	
Secondary education	37 (19.4)	27 (23.1)	10 (13.5)	
Post-secondary education	13 (6.8)	12 (10.2)	1 (1.4)	
Family income				$\chi^2 (7) = 12.83$
Below $1,999	13 (6.8)	4 (3.5)	9 (12.2)	
$2,000-3,999	27 (14.1)	15 (12.8)	12 (16.2)	
$4,000-5,999	29 (15.2)	18 (15.4)	11 (14.9)	
$6,000-9,999	26 (13.6)	20 (17.1)	6 (8.1)	
$10,000-14,999	32 (16.8)	17 (14.5)	15 (20.3)	
$15,000-$19,999	16 (8.4)	9 (7.7)	7 (10.1)	
$20,000-$29,999	20 (10.5)	13 (11.1)	7 (10.1)	
$30,000 or above	14 (7.3)	12 (10.3)	2 (2.7)	
Missing	14 (7.3)	9 (7.7)	5 (6.8)	
Employment Status				$\chi^2 (1) = .12$
Working	9 (4.7)	5 (4.3)	4 (5.4)	
Unemployed/Retired	181 (94.7)	111 (94.9)	70 (94.6)	
Living Arrangement				$\chi^2 (2) = .41$
Alone	24 (12.5)	14 (12.0)	10 (13.5)	
In hostel	4 (2.1)	3 (2.6)	1 (1.4)	
With family	163 (85.3)	100 (85.5)	63 (85.1)	
Religious Affiliation				$\chi^2 (4) = 32.87$**
Yes-Ancestor	15 (7.9)	13 (11.1)	2 (2.7)	
Chinese Gods	78 (40.8)	31 (26.5)	47 (63.5)	
Buddhism/Taoism	6 (3.1)	3 (2.6)	3 (4.1)	
Christianity/Catholic	14 (7.3)	7 (6.0)	7 (9.5)	
No	78 (40.8)	63 (53.8)	15 (20.3)	

Note: Numbers in parenthesis represent percentages.
* $p < .01$; ** $p < .001$

Table 2 Medical Information of the Participants

Medical Variable	Total (N = 191)	Male (N = 117)	Female (N = 74)	Gender difference across categories
		N (%)		
DM duration				$\chi^2(5) = 4.97$
Less than 1 year	30 (15.7)	21 (17.9)	9 (12.2)	
>1 year but <5 years	33 (17.3)	21 (17.9)	12 (16.2)	
>5 years but <10 years	28 (14.7)	19 (16.2)	9 (12.2)	
>10 years but <15 years	48 (25.1)	24 (20.5)	24 (32.4)	
>15 years but <20 years	27 (14.1)	15 (12.8)	12 (16.2)	
Over 20 years	25 (13.1)	17 (14.5)	8 (10.8)	
Treatment				$\chi^2(3) = 1.72$
Exercise and diet	16 (8.4)	12 (10.3)	4 (5.4)	
Medicine	97 (50.8)	57 (48.7)	40 (54.1)	
Insulin injection	55 (28.8)	33 (28.2)	22 (29.7)	
All	23 (12.0)	15 (12.8)	8 (10.8)	
Have visited the center for				$\chi^2(3) = .306$
First time	37 (19.5)	24 (20.5)	13 (17.8)	
2-9 times	97 (51.5)	59 (50.4)	38 (52.1)	
10-29 times	37 (19.5)	23 (19.7)	14 (19.2)	
More than 30 times	19 (10.0)	11 (9.4)	8 (11.0)	

Note: Numbers in parenthesis represent percentages.

Table 3 Descriptive Statistics of the Psychological Variables (Time 1)

	Internal, consistency (alpha)	Gender Difference				Blood Glucose Control		
		Total (n=191)	Male (n=117)	Female (n=74)	t-value	Good control (n=84)	Poor control (n=95)	t-value
Health habit index	.8170	2.92 (.30)	2.91 (.32)	2.93 (.27)	-.41	2.95 (.28)	2.89 (.29)	1.60
Diabetes related habits	.7278	3.18 (.36)	3.15 (.38)	3.23 (.33)	-1.60	3.24 (.34)	3.13 (.36)	1.94#
Preventive health habits	.6384	2.42 (.44)	2.46 (.44)	2.36 (.42)	1.44	2.48 (.40)	2.37 (.45)	1.62
Self-efficacy	.7122	2.73 (.50)	2.73 (.50)	2.72 (.51)	.14	2.77 (.53)	2.71 (.47)	.80
Health value	.8236	3.34 (.58)	3.27 (.58)	3.44 (.55)	-2.00*	3.43 (.53)	3.26 (.62)	1.72
Health locus of control								
Internal (IHLC)	.8339	2.98 (.53)	2.97 (.55)	2.99 (.52)	-.24	3.01 (.57)	2.95 (.49)	-.71
Chance- external (CHLC)	.8399	2.51 (.70)	2.33 (.68)	2.78 (.64)	-4.59***	2.46 (.71)	2.54 (.66)	-.85
Doctor- external (DHLC)	.7733	3.51 (.47)	3.46 (.50)	3.57 (.43)	-1.54	3.57 (.43)	3.43 (.51)	1.97*
Others- external (OHLC)	.8558	2.41 (.86)	2.42 (.86)	2.40 (.85)	.17	2.37 (.85)	2.44 (.84)	-.61
SF_36								
Physical functioning (PF)	.7911	80.87 (15.43)	83.09 (14.95)	77.43 (15.64)	2.49*	82.28 (13.58)	81.52 (15.56)	.34
Role limitation – physical (RP)	.9217	73.82 (39.53)	79.74 (35.80)	64.53 (43.40)	2.52*	70.63 (40.33)	79.25 (37.68)	-1.46
Role limitation – emotional (RE)	.9356	78.36 (38.81)	81.48 (37.00)	73.42 (41.28)	1.37	76.54 (40.98)	79.43 (37.58)	-.49
Bodily pain (BP)	.9209	76.96 (27.95)	80.00 (27.35)	72.16 (28.39)	1.90	77.41 (27.42)	78.94 (28.30)	-.36
General health (GH)	.7783	57.54 (21.80)	60.80 (22.15)	52.38 (20.33)	2.64**	56.74 (22.28)	58.59 (21.60)	-.46
Vitality (V)	.7858	70.59 (20.21)	74.30 (20.45)	64.79 (18.53)	3.21**	69.50 (20.95)	72.93 (19.53)	-1.11
Social functioning (SF)	.7846	89.53 (22.36)	90.49 (21.00)	88.01 (24.43)	.75	88.73 (23.52)	91.22 (19.81)	-.76
Mental health (MH)	.8058	80.57 (18.20)	82.93 (18.14)	76.86 (17.79)	2.27*	80.50 (20.11)	81.02 (17.10)	-.19

Note: The parameter inside blankets represents the standard deviation.

* $p < .05$; ** $p < .01$; **** $p < .001$; #p = .055

Table 4 Relationships between Demographics and Psychosocial Variables (Time 1)

	Age[1]	Living arrangement[2]	Education[2]	Family income[2]	Religion[2]	DM duration[1]	Treatment[2]	Center visits[2]
Health habit index	-.093	.100	1.665	.476	2.890*	.099	.052	1.241
Diabetes-related habits	-.081	.857	1.260	.816	2.331	.088	.891	1.106
Preventive health habits	-.192**	.887	8.680***	.926	2.612**	.053	.548	1.771
SE	.079	.321	.474	.799	1.137	.108	1.032	.451
HV	-.102	1.045	.256	.980	.651	-.075	.553	.859
IHLC	-.217**	2.558	1.574	.478	.960	-.017	.771	.784
CHLC	.076	2.041	9.242***	1.016	4.539**	.066	1.749	1.642
DHLC	-.005	1.682	1.873	1.865	1.321	-.061	.816	.811
OHLC	-.015	8.779***	.219	.464	.067	.037	.282	.275
SF_36								
PF	-.404**	.128	1.845	1.140	.711	-.129	2.769*	1.601
RP	-.116	.166	.791	2.879**	1.519	-.054	2.354	.382
RE	.087	1.062	.434	2.362*	.275	.055	2.189	.350
BP	-.224**	.169	.491	2.058	1.099	-.177*	2.217	3.414*
GH	.012	.578	.584	1.648	.871	-.124	1.188	.009
V	-.064	.893	.979	1.340	.840	-.127	.897	.223
SF	.056	1.505	1.674	1.243	2.339	-.014	1.201	.806
MH	.036	.975	2.397	1.541	.593	.051	1.928	.410

Note: * p< . 05; ** p< . 01; **** p< . 001

1. Pearson r
2. F value of ANOVA

SE Self-efficacy
HV Health value
IHLC Internal health locus of control
CHLC Chance- external health locus of control
DHLC Doctor- external health locus of control
OHLC Others- external health locus of control
PF Physical functioning
RP Role limitation – physical
RE Role limitation – emotional
BP Bodily pain
GH General health
V Vitality
SF Social functioning
MH Mental health

Table 5 Exploratory Factor Analysis Results on Practice of Specific Health Habits (Time 1)

		Endorsement[1] [N (%)]		Mean	SD	Factor loading	
		1st phase (N=191)	2nd phase (N=144)			Factor 1	Factor 2
1.	Exercise routinely	140 (73.3)	102 (72.3)	2.92	.84	.330	
2.	Gather health-related information from mass media	136 (71.2)	113 (78.5)	2.79	.68		.521
3.	Have regular dental check	39 (20.4)	24 (16.7)	1.83	.91		.571
4.	Discuss health-related issues with others	90 (47.4)	57 (39.6)	2.42	.81		.558
5.	Limit intake of foods like coffee, sugar, salt and fats	177 (92.6)	131 (91.0)	3.21	.60	.584	
6.	Watch weight	149 (78.0)	117 (81.3)	2.95	.71	.471	
7.	Keep emergency numbers near phone/on pocket	104 (54.4)	95 (66.4)	2.58	.76		.210
8.	Destroy old/unused medicine	156 (81.7)	88 (61.1)	2.97	.67		
9.	Watch condition of electrical appliance	140 (73.3)	88 (61.5)	2.89	.76		.571
10.	Check home first aid kit regularly	105 (54.9)	77 (53.5)	2.49	.87		.464
11.	Not drink alcohol	171 (89.5)	129 (89.6)	3.60	.70	.560	
12.	Not take harmful chemicals	161 (84.3)	123 (85.4)	3.08	.69		
13.	Not smoke	165 (86.4)	124 (86.1)	3.54	.86	.546	
14.	Avoid polluted areas	181 (94.8)	136 (94.4)	3.21	.54		
15.	Eat balanced diet	179 (93.7)	130 (90.9)	3.14	.49	.495	
16.	Watch for possible signs of health problems	159 (83.3)	124 (86.7)	3.12	.71	.607	
17.	Avoid over-the-counter medicine	126 (66.0)	96 (66.7)	2.85	.88		
18.	Brush teeth	171 (90.0)	118 (81.9)	3.30	.66		
19.	Stay away from places with germs	179 (93.7)	137 (95.1)	3.22	.58		
20.	Report symptoms to doctor	168 (88.4)	130 (90.3)	3.22	.67	.462	
21.	Question doctor and give opinion	105 (55.3)	76 (52.8)	2.63	.79	.362	
22.	Attend health care program	42 (22.2)	16 (11.2)	1.83	.86		.395
23.	Read food labels	120 (62.8)	86 (59.7)	2.56	.89		.506
24.	Eat roughage/fiber	183 (95.8)	140 (97.2)	3.42	.57	.670	
25.	Express feelings	122 (63.9)	81 (56.3)	2.74	.77		
26.	Have pleasant bedtime thought	155 (81.2)	112 (77.8)	3.05	.65		
27.	Have regular blood glucose self-test	162 (84.9)	121 (86.0)	3.24	.78	.408	

Note: 1 Item responses of "strongly agree" and "agree" are regarded as endorsement of the given behavior item.

Table 6 Correlation matrix of the Psychosocial Variables (Time 1)

Time 1	Health habit index	Diabetes related habits	Preventive health habits	SE	HV	IHLC	CHLC	DHLC	OHLC	PF	RP	RE	BP	GH	V	SF	MH
Health habit index	-	.865**	.746**	.526**	.525**	.355**	-.120	.313*	.051	.251**	.125*	.108	.090	.130	.211*	.026	.202*
Diabetes related habits		-	.425**	.430**	.489**	.333**	-.015	.411**	.073	.185*	.099	.102	.064	.116	.130	.020	.131
Preventive health habits			-	.356**	.379**	.272**	-.239**	.082	.152**	.218**	.128	.079	.041	.096	.158*	-.010	.136
SE				-	.299**	.194**	-.177*	.130	.096	.200**	.001	.000	.082	.153*	.239**	.017	.326**
HV					-	.273**	-.039	.279**	.068	.199**	.030	-.082	.095	-.004	.209**	-.071	-.015
IHLC						-	-.123	.340**	.277**	.256**	.243**	.005	.136	.084	.154*	.052	.108
CHLC							-	.034	.067	-.268**	-.110	.020	-.098	-.161*	-.270**	-.092	-.175
DHLC								-	.109	.042	-.121	-.050	-.148*	-.046	-.039	-.089	-.035
OHLC									-	-.071	-.058	-.176*	-.001	-.091	-.060	-.231**	-.039
SF_36																	
PF										-	.330**	.101	.456**	.343**	.511**	.243**	.313**
RP											-	.450**	.329**	.256**	.240**	.396**	.298**
RE												-	.209**	.336**	.176*	.526**	.364**
BP													-	.395**	.366**	.272**	.209**
GH														-	.517**	.311**	.336**
V															-	.270**	.576**
SF																-	.357**
MH																	-

Note: * p< . 05; ** p< . 01

SE	Self-efficacy
HV	Health value
IHLC	Internal health locus of control
CHLC	Chance- external health locus of control
DHLC	Doctor- external health locus of control
OHLC	Others- external health locus of control
PF	Physical functioning
RP	Role limitation – physical
RE	Role limitation – emotional
BP	Bodily pain
GH	General health
V	Vitality
SF	Social functioning
MH	Mental health

Table 7 Regression Analysis Results of Health Habit Index (Time 1)

Model	Variables in the model,	R-square change	F Change	Sig. F Change	Standardized Coefficient (Beta)	t	Sig.
1.		.053	10.33	.002			
	(Constant)					23.08	.000
B1	Physical functioning				.229	3.22	.002
2.		.031	6.29	.013			
	(Constant)					23.11	.000
B1	Physical functioning				.235	3.34	.001
B1	Religion (Western)				.177	2.51	.013
3.		.220	58.29	.000			
	(Constant)					15.50	.000
B1	Physical functioning				.140	2.23	.027
B1	Religion (Western)				.114	1.83	.068
B2	Self efficacy				.483	7.64	.000
4.		.126	40.58	.000			
	(Constant)					11.87	.000
B1	Physical functioning				.086	1.49	.138
B1	Religious (Western)				.095	1.75	.082
B2	Self efficacy				.385	6.48	.000
B2	Health value				.376	6.37	.000
5.		.027	9.14	.003			
	(Constant)					7.98	.000
B1	Physical functioning				.088	1.56	.120
B1	Religious (Western)				.095	1.73	.086
B2	Self efficacy				.374	6.43	.000
B2	Health value				.330	5.52	.000
B2	Doctor health locus of control				.172	3.02	.003
6.		.015	5.12	.025			
	(Constant)					7.67	.000
B1	Physical functioning				.061	1.07	.288
B1	Religious (Western)				.094	1.73	.085
B2	Self efficacy				.364	6.30	.000
B2	Health value				.313	5.25	.000
B2	Doctor health locus of control				.134	2.27	.025
B2	Internal health locus of control				.136	2.26	.025
	R-square of the finalized model	.473					

Table 8 Correlation matrix of the Psychosocial Variables (by Gender) (Time 1)

Male Female	Health habit index	Diabetes related habits	Preventiv e health habits	SE	HV	IHLC	CHLC	DHLC	OHLC	PF	RP	RE	BP	GH	V	SF	MH
Health habit index		.893**	.767**	.543**	.503**	.343**	-.188*	.351**	.182*	.251**	.048	.136	.150	.158	.244**	-.009	.249**
Diabetes related habits	.814**		.505**	.441**	.470**	.327**	-.110	.143	.459**	.190*	.020	.116	.085	.147	.182	-.073	.212*
Preventive health habits	.730**	.323**		.387**	.412**	.285**	-.195*	.147	.202*	.196*	.059	.068	.086	.073	.116	-.058	.036
SE	.502**	.425**	.308**		.268**	.278**	-.254**	.138	.140	.286**	.012	.074	.142	.250**	.318**	.007	.418**
HV	.575**	.501**	.377**	.363**		.270**	-.197*	.251**	.053	.241*	-.019	-.123	.111	.004	.290**	-.064	.036
IHLC	.378**	.347**	.260*	.054	.279*		-.147	.329**	.323**	.262**	.226*	.023	.171	.095	.141	.015	.168
CHLC	-.036	.051	-.260*	-.067	.097	-.116		-.078	.060	-.249**	-.081	.023	-.096	-.175	-.262**	-.131	-.168
DHLC	.228	.287*	-.008	.121	.299**	.365**	.147		.187*	.047	-.125	-.028	-.108	-.053	-.027	-.104	-.017
OHLC	.028	-.051	.066	.028	.100	.200	.100	-.028		.034	-.083	-.125	-.044	-.109	-.085	-.269**	-.034
PF	.241*	.244*	.212	.075	.254*	.266*	-.192	.088	-.240*		.266**	-.052	.427**	.339**	.446**	.161	.308**
RP	.231*	.284*	.186	-.019	.169	.291*	-.019	-.072	-.033	.358**		.344**	.256**	.291**	.133	.260**	.297**
RE	.094	.116	.072	-.106	.013	-.016	.047	-.057	-.255*	.271*	.550**		.165	.249**	.050	.493**	.340**
BP	.001	.074	-.067	-.011	.126	.090	.002	-.184	.062	.465**	.385**	.244*		.389**	.312**	.295**	.289**
GH	.124	.129	.088	-.009	.059	.078	.013	.029	-.072	.293*	.398**	.445**	.366**		.469**	.271**	.559**
V	.175	.118	.185	.117	.179	.218	-.125	.012	-.030	.571**	.315**	.330**	.402**	.543**		.180	.564**
SF	.097	.186	.045	.029	-.064	.110	-.004	-.055	-.185	.337**	.538**	.562**	.233*	.365**	.385**		.317**
MH	.132	.044	.147	.187	-.038	.016	-.075	-.020	-.053	.271*	.250*	.375**	.258*	.500**	.552**	.407**	

Note: * p< . 05; ** p< . 01

SE	Self-efficacy
HV	Health value
IHLC	Internal health locus of control
CHLC	Chance- external health locus of control
DHLC	Doctor- external health locus of control
OHLC	Others- external health locus of control
PF	Physical functioning
RP	Role limitation – physical
RE	Role limitation – emotional
BP	Bodily pain
GH	General health
V	Vitality
SF	Social functioning
MH	Mental health

Table 9 Regression Analysis Results of Diabetes-related Habits (Time 1)

Model	Variables in the model	R-square change	F Change	Sig. F Change	Standardized Coefficient (Beta)	t	Sig.
1.		.031	6.04	.015			
	(Constant)					20.66	.000
B1	Physical functioning				.177	2.46	.015
2.		.026	5.09	.025			
	(Constant)					20.63	.000
B1	Physical functioning				.183	2.56	.011
B1	Religion (Western)				.161	2.26	.025
3.		.194	47.74	.000			
	(Constant)					12.44	.000
B1	Physical functioning				.095	1.46	.147
B1	Religion (Western)				.128	1.99	.048
B2	Health value				.450	6.91	.000
4.		.086	23.88	.000			
	(Constant)					7.00	.000
B1	Physical functioning				.096	1.57	.119
B1	Religious (Western)				.120	1.98	.049
B2	Health value				.364	5.68	.000
B2	Doctor health locus of control				.307	4.89	.000
5.		.067	20.54	.000			
	(Constant)					5.69	.000
B1	Physical functioning				.055	.94	.351
B1	Religious (Western)				.090	1.55	.123
B2	Health value				.297	4.75	.000
B2	Doctor health locus of control				.291	4.86	.000
B2	Self-efficacy				.276	4.53	.000
	R-square of the finalized model	.405					

Table 10 Regression Analysis Results of Preventive Health Habits (Time 1)

Model	Variables in the model	R-square change	F Change	Sig. F Change	Standardized Coefficient (Beta)	t	Sig.
1.		.100	20.75	.000			
	(Constant)					27.72	.000
B1	Educational level				.317	4.56	.000
2.		.031	6.51	.012			
	(Constant)					10.41	.000
B1	Educational level				.298	4.32	.000
B1	Physical functioning				.176	2.55	.012
3.		.018	3.95	.049			
	(Constant)					10.39	.000
B1	Educational level				.283	4.11	.000
B1	Physical functioning				.182	2.66	.009
B1	Religion (Western)				.136	1.99	.049
4.		.102	24.99	.000			
	(Constant)					5.06	.000
B1	Educational level				.287	4.43	.000
B1	Physical functioning				.118	1.79	.075
B1	Religion (Western)				.111	1.72	.087
B2	Health value				.327	5.00	.000
5.		.045	11.73	.001			
	(Constant)					3.41	.001
B1	Educational level				.281	4.47	.000
B1	Physical functioning				.085	1.32	.190
B1	Religion (Western)				.087	1.37	.172
B2	Health value				.268	4.08	.000
B2	Self-efficacy				.227	3.43	.001
6.		.023	6.06	.015			
	(Constant)					2.33	.021
B1	Educational level				.291	4.68	.000
B1	Physical functioning				.052	.80	.424
B1	Religion (Western)				.084	1.34	.181
B2	Health value				.236	3.56	.000
B2	Self-efficacy				.211	3.22	.002
B2	Internal health locus of control				.162	2.46	.015
	R-square of the finalized model	.320					

Table 11 Correlation matrix of the Psychosocial Variables (Time 1 and Time 2)

Time 1 / Time 2	Health habit index	Diabetes related habits	Preventive health habits	SE	HV	IHLC	CHLC	DHLC	OHLC	PF	RP	RE	BP	GH	V	SF	MH
SF_36																	
PF	.225**	.215**	.170*	.205*	.176*	.234**	-.228**	-.009	-.064	-							
RP	.201*	.223**	.049	.103	.139	.197*	-.227**	.130	.112	.273**	-						
RE	.107	.164*	-.028	.180*	-.006	.090	-.135	-.036	-.060	.331**	.212*	-					
BP	.145	.145	.069	.99	.096	.213**	-.097	-.005	.063	.551**	.257**	.199*	-				
GH	.221**	.259**	.109	.238**	.064	.159	-.087	.068	.016	.452**	.409**	.344**	.306**	-			
V	.202*	.262**	.081	.248**	.091	.139	-.218**	.031	.043	.583**	.358**	.310**	.327**	.534**	-		
SF	.134	.230*	.025	.156	.078	.250**	-.125	.079	.016	.508**	.262**	.186*	.275**	.312**	.481**	-	
MH	.181*	.166*	.111	.274**	-.049	.138	-.170*	-.037	.066	.301**	.287**	.318**	.260**	.498**	.490**	.368**	-

Note: * p< . 05; ** p< . 01

SE	Self-efficacy
HV	Health value
IHLC	Internal health locus of control
CHLC	Chance- external health locus of control
DHLC	Doctor- external health locus of control
OHLC	Others- external health locus of control
PF	Physical functioning
RP	Role limitation – physical
RE	Role limitation – emotional
BP	Bodily pain
GH	General health
V	Vitality
SF	Social functioning
MH	Mental health

Table 12 Correlation matrix of the Psychosocial Variables (Time 2)

	Health habit index	Diabetes related habits	Preventive health habits	PF	RP	RE	BP	GH	V	SF	MH
Health habit index	-										
Diabetes related habits	.830**	-									
Preventive health habits	.634**	.261**	-								
SF_36											
PF	.222**	.203*	.289**	-							
RP	.204*	.205*	.034	315**	-						
RE	.144	.094	.104	.470**	.367**	-					
BP	.096	.128	.116	.653**	.243**	.480**	-				
GH	.231**	.236**	.153	.550**	.347**	.497**	.515**	-			
V	.259**	.242**	.215**	.704**	.358**	.568**	.538**	.712**	-		
SF	.174*	.182*	.172*	.667**	.370**	.604**	.565**	.490**	.614**	-	
MH	.184*	.179*	.167*	.434**	.234**	.477**	.498**	.590**	.612**	.539**	-

Note: * $p < .05$; ** $p < .01$

PF Physical functioning
RP Role limitation – physical
RE Role limitation – emotional
BP Bodily pain
GH General health
V Vitality
SF Social functioning
MH Mental health

Table 13 Descriptive Statistics of the Psychosocial Variables (Time 2)

	Reliability of stability (test-retest reliability, r)	Total (n = 148)	Male (n=89)	Female (n=59)	Repeated measure, F (with 1st phase)		
		Mean (SD)	Mean (SD)	Mean (SD)	Within (Time)	Between (Gender)	Interaction (Time*Gender)
Health habit index	.781**	2.93 (.26)	2.91 (.28)	2.95 (.24)	.32	.17	2.03
Diabetes-related habits	.747**	3.20 (.33)	3.18 (.03)	3.22 (.04)	.25	.71	.73
Preventive health habits	.664**	2.43 (.42)	2.47 (.04)	2.38 (.05)	.02	1.86	1.18
SF_36							
PF	.802**	77.26 (22.23)	80.52 (21.38)	72.46 (22.77)	8.88**	5.16*	.47
RP	.169*	76.70 (69.59)	80.68 (84.40)	70.76 (38.04)	.04	1.62	.04
RE	.351**	84.68 (33.31)	84.64 (34.10)	84.75 (32.35)	2.85	.01	.08
BP	.526**	76.16 (30.59)	79.33 (31.40)	71.23 (28.85)	.26	5.35	.91
GH	.671**	57.62 (26.58)	60.58 (27.75)	53.07 (24.21)	.01	4.94*	.21
V	.700**	67.97 (19.00)	71.38 (19.03)	62.84 (17.92)	1.85	12.26**	1.46
SF	.362**	87.33 (26.08)	88.76 (26.79)	85.17 (25.05)	.64	.62	.708
MH	.656**	75.30 (19.40)	77.73 (20.25)	71.66 (17.80)	14.91***	6.03*	.49

Note: * p< . 05; ** p< . 01; **** p< . 001

PF Physical functioning
RP Role limitation – physical
RE Role limitation – emotional
BP Bodily pain
GH General health
V Vitality
SF Social functioning
MH Mental health

Table 14 Regression Analysis Results of Health Habit Index (Time 2)

Model	Variables in the model	R-square change	F Change	Sig. F Change	Standardized Coefficient (Beta)	t	Sig.
1.		.044	6.73	.010			
	(Constant)					35.59	.000
B1	Physical functioning (T2)				.211	2.60	.010
2.		.041	6.38	.013			
	(Constant)					35.59	.000
B1	Physical functioning (T2)				.222	2.78	.006
B1	Religion (Western)				.202	2.53	.013
3.		.056	9.37	.003			
	(Constant)					34.25	.000
B1	Physical functioning (T2)				.233	3.00	.003
B1	Religion (Western)				.260	3.25	.001
B1	Religion (Chinese Gods)				.244	3.06	.003
4.		.475	175.55	.000			
	(Constant)					6.88	.000
B1	Physical functioning (T2)				.066	1.22	.223
B1	Religion (Western)				.096	1.74	.083
B1	Religion (Chinese Gods)				.118	2.17	.032
B2	Health habit index (T1)				.729	13.25	.000
5.		.015	5.87	.017			
	(Constant)					6.85	.000
B1	Physical functioning (T2)				.051	.97	.335
B1	Religion (Western)				.088	1.62	.108
B1	Religion (Chinese Gods)				.126	2.34	.020
B2	Health habit index (T1)				.660	10.82	.000
B3	Self-efficacy				.145	2.42	.017
	R-square of the finalized model	.631					

Table 15 Regression Analysis Results of Diabetes-related Habit (Time 2)

Model	Variables in the model	R-square change	F Change	Sig. F Change	Standardized Coefficient (Beta)	t	Sig.
1.		.038	5.71	.018			
	(Constant)					30.59	.000
B1	Physical Functioning (T2)				.195	2.39	.018
2.		.041	6.42	.012			
	(Constant)					30.55	.000
B1	Physical Functioning (T2)				.206	2.57	.011
B1	Religion (Western)				.203	2.53	.012
3.		.040	6.43	.012			
	(Constant)					29.12	.000
B1	Physical Functioning (T2)				.215	2.73	.007
B1	Religion (Western)				.252	3.11	.002
B1	Religion (Chinese God)				.205	2.54	.012
4.		.448	146.79	.000			
	(Constant)					6.51	.000
B1	Physical Functioning (T2)				.057	.99	.322
B1	Religion (Western)				.113	1.95	.054
B1	Religion (Chinese God)				.061	1.05	.295
B2	Diabetes-related habits (T1)				.707	12.12	.000
5.		.025	8.81	.004			
	(Constant)					5.95	.000
B1	Physical Functioning (T2)				.035	.63	.531
B1	Religion (Western)				.098	1.72	.088
B1	Religion (Chinese God)				.070	1.24	.217
B2	Diabetes-related habits (T1)				.637	10.35	.000
B3	Self-efficacy				.179	2.97	.004
6.		.020	7.21	.008			
	(Constant)					5.40	.000
B1	Physical Functioning (T2)				.024	.44	.662
B1	Religion (Western)				.092	1.66	.099
B1	Religion (Chinese God)				.076	1.38	.171
B2	Diabetes-related habits (T1)				.567	8.64	.000
B3	Self-efficacy				.170	2.87	.005
B3	Health value				.161	2.69	.008
	R-square of the finalized model	.612					

Table 16 Regression Analysis Results of Preventive Health Habit (Time 2)

Model	Variables in the model	R-square change	F Change	Sig. F Change	Standardized Coefficient (Beta)	t	Sig.
1.		.124	20.60	.000			
	(Constant)					23.75	.000
B1	Educational level				.353	4.54	.000
2.		.064	11.31	.001			
	(Constant)					12.91	.000
B1	Educational level				.332	4.41	.000
B1	Physical functioning (T2)				.253	3.36	.001
3.		.028	5.19	.024			
	(Constant)					12.95	.000
B1	Educational level				.313	4.18	.000
B1	Physical functioning (T2)				.265	3.56	.001
B1	Religion (Western)				.170	2.28	.024
4.		.030	5.59	.019			
	(Constant)					11.23	.000
B1	Educational level				.365	4.75	.000
B1	Physical functioning (T2)				.268	3.66	.000
B1	Religion (Western)				.208	2.77	.006
B1	Religion (Chinese God)				.185	2.36	.019
5.		.261	74.49	.000			
	(Constant)					3.69	.000
B1	Educational level				.194	2.96	.004
B1	Physical functioning (T2)				.187	3.10	.002
B1	Religion (Western)				.106	1.70	.091
B1	Religion (Chinese God)				.146	2.30	.023
B2	Preventive habits (T1)				.554	8.63	.000
	R-square of the finalized model	.507					

Appendix A

Health Habits Checklist

如果用下列的句子來形容在過去三個月的你，你認爲有多同意？	非常不同意 (1)	不同意 (2)	同意 (3)	非常同意 (4)
1. 你經常做運動？	☐	☐	☐	☐
2. 你從電視、收音機、書、報章或雜誌收集有關健康的資訊？	☐	☐	☐	☐
3. 你定期見牙醫做檢查？	☐	☐	☐	☐
4. 你和朋友、鄰居及親戚討論有關健康的問題？	☐	☐	☐	☐
5. 你限制自己進食過量例如咖啡、糖、鹽或脂肪等食物？	☐	☐	☐	☐
6. 你留意自己的體重？	☐	☐	☐	☐
7. 你將緊急的電話號碼放在電話附近？	☐	☐	☐	☐
8. 你丟棄/消毀舊的或從未用過的藥物？	☐	☐	☐	☐
9. 你留意電器的情況以防意外？	☐	☐	☐	☐
10. 你定期檢查家中的急救箱？	☐	☐	☐	☐
11. 你不喝酒？	☐	☐	☐	☐
12. 你不食用對身體有害的化學品，如食物添加劑、防腐劑、毒品等？	☐	☐	☐	☐
13. 你不吸煙？	☐	☐	☐	☐
14. 你避免到嚴重污染(如空氣、海水污染)的地方？	☐	☐	☐	☐
15. 你飲食均衡？	☐	☐	☐	☐
16. 你留意有可能代表主要疾病(如癌症、爛足)的身體症狀？	☐	☐	☐	☐
17. 你避免食成藥(藥房買的)？	☐	☐	☐	☐
18. 你早晚刷牙/清潔口腔?	☐	☐	☐	☐
19. 你避免到細菌充斥的地方？	☐	☐	☐	☐
20. 你主動向醫生報告病徵？	☐	☐	☐	☐
21. 你主動向醫生發問或提供意見？	☐	☐	☐	☐
22. 你參與有關健康護理的活動？	☐	☐	☐	☐
23. 你會閱讀食物上的標籤？	☐	☐	☐	☐
24. 你進食纖維質食物(如蔬果)？	☐	☐	☐	☐
25. 你將感情表現出來？	☐	☐	☐	☐
26. 臨睡時，你想的是愉快的事情？	☐	☐	☐	☐
27. 你定時自己檢查血糖水平？	☐	☐	☐	☐

Appendix B

Self-efficacy (Toward Health Habits) and Health Value Scales

請問你有多同意下列各句子呢？	非常不同意(1)	不同意(2)	同意(3)	非常同意(4)
1. 若你真正要的話，你肯定可以堅持剛才提過的健康習慣？	☐	☐	☐	☐
2. 若你打算繼續剛才提過的健康習慣，你知道你可以持之以恆？	☐	☐	☐	☐
3. 你不知道你能否處理因做剛才提過的健康行爲而引起的困難？	☐	☐	☐	☐
4. 通常你都沒有足夠的耐性去實踐剛才提過的健康習慣？	☐	☐	☐	☐
5. 那些不健康的行爲(如喝酒、食美味但對身體有害的食物等)的誘惑令你常常不能抗拒？	☐	☐	☐	☐
6. 你常因沒有足夠的時間、金錢、體力、記憶力等去實踐剛才提過的健康習慣？	☐	☐	☐	☐

7. 你經常想有關你健康的問題？	☐	☐	☐	☐
8. 你很關心你的健康？	☐	☐	☐	☐
9. 你認爲“人要注意其健康”這想法是很重要的？	☐	☐	☐	☐
10. 在將來，你很可能嘗試去更小心地照料自己的身體？	☐	☐	☐	☐

Appendix C

Multidimensional Health Locus of Control Scales

請問你有多同意下列各句子呢？句子中的「病況」指被訪者的糖尿病的情況	非常不同意 (1)	不同意 (2)	同意 (3)	非常同意 (4)
1. 若你行運，你的病況就會轉好。	☐	☐	☐	☐
2. 你要爲自己的病況變好或轉壞負上直接的責任。	☐	☐	☐	☐
3. 在決定你的病況有多少改善上，運氣佔一個很大的部分。	☐	☐	☐	☐
4. 若你的病況惡化，這是命運安排。	☐	☐	☐	☐
5. 若你定期睇醫生，你的病況就會較少可能出問題。	☐	☐	☐	☐
6. 若你的病況轉好，你應受到嘉許; 相反地若你的病況變壞，你便應受到責備。.	☐	☐	☐	☐
7. 爲令你的病況改善，只有靠家人去確保事情都適當地發生。	☐	☐	☐	☐
8. 你的病況若惡化，是由於你並無適當地照顧你自己。	☐	☐	☐	☐
9. 你的病況若有任何改善，多數是因爲你好運。	☐	☐	☐	☐
10. 徹底跟隨醫生的指示是避免你的病況轉壞的最好方法。	☐	☐	☐	☐
11. 家人對你的病況是否改變有很大影響。	☐	☐	☐	☐
12. 在你的病況來說，要發生的總會發生，好就好，要壞就壞。	☐	☐	☐	☐
13. 若你的病況出任何問題都是你自己的錯。	☐	☐	☐	☐
14. 若你的病況惡化，你的行爲會影響你幾時好返 o 的。	☐	☐	☐	☐
15. 無論何時你的病況若轉壞，你應該向曾受訓練的醫護人員求教。	☐	☐	☐	☐
16. 你的病況主要受你做 o 的乜所影響。	☐	☐	☐	☐
17. 大多數影響你病況的事都係偶然咁發生。	☐	☐	☐	☐
18. 家人對你所給予的援助形式，會決定你的病況何時有改善。	☐	☐	☐	☐